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CONSTANTS

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HANDBOOK OF ELECTROCHEMICAL CONSTANTS

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1. VALUES OF IMPORTANT CONSTANTS

(***N***, ***F*** and ***R*** for the chemical mole)

AVOGADRO'S NUMBER

$\boldsymbol{N} = (6{\cdot}023\,0 \pm 0{\cdot}000\,2) \times 10^{23}\ \text{mole}^{-1}$

CHARGE ON THE ELECTRON

$e = (4{\cdot}802\,94 \pm 0{\cdot}000\,08) \times 10^{-10}$ e.s.u.
$= (1{\cdot}602\,09 \pm 0{\cdot}000\,03) \times 10^{-20}$ e.m.u.
$= (1{\cdot}602\,09 \pm 0{\cdot}000\,03) \times 10^{-19}$ coulomb

FARADAY CONSTANT

$\boldsymbol{F} = (9{,}649{\cdot}3 \pm 0{\cdot}2)$ e.m.u. equivalent^{-1}
$= (96{,}493 \pm 2)$ coulomb equivalent^{-1}

GAS CONSTANT

$\boldsymbol{R} = (8{\cdot}314\,7 \pm 0{\cdot}000\,05)$ joule deg.$^{-1}$ mole^{-1}
$= (1{\cdot}987\,2 \pm 0{\cdot}000\,01)$ cal.deg.$^{-1}$ mole^{-1}
$= (0{\cdot}082\,057 \pm 0{\cdot}000\,000\,5)$ l.atm.deg.$^{-1}$mole^{-1}

BOLTZMANN'S CONSTANT

$\boldsymbol{k} = (1{\cdot}380\,49 \pm 0{\cdot}000\,05) \times 10^{-16}$ erg deg.$^{-1}$

ICE POINT

$T_{0^\circ\text{C}} = (273{\cdot}150\,0 \pm 0{\cdot}000\,2)^\circ\text{K}$

VELOCITY OF LIGHT

$C = (2{\cdot}997\,928 \pm 0{\cdot}000\,004) \times 10^{10}$ cm sec^{-1}

PLANCK'S CONSTANT

$\boldsymbol{h} = (6{\cdot}6254 \pm 0{\cdot}000\,2) \times 10^{-27}$ erg sec

STANDARD ATMOSPHERE

1 atm. = 1,013,250 dyne cm^{-2}

STANDARD GRAVITATIONAL ACCELERATION

$g_o = 980{\cdot}665$ cm sec^{-1}

DEFINED CALORIE

1 cal. = 4·1840 joules

RELATION BETWEEN CHEMICAL AND PHYSICAL MOLE

1 phys. mole = 1·000 275 chem. mole

RELATION BETWEEN LITRE AND CUBIC CENTIMETRE

1 l. = (1,000·028 ± 0·004) cm^3

2 IONIC RADII IN ANGSTROM UNITS AND IONIZATION POTENTIALS IN ELECTRON VOLTS

Element	Radius for Charge	Ionization Potential							
		1	2	3	4	5	6	7	8
Ac	1·18 3+				49	62	76	95	109
Ag	1·26 1+	7·58	21·4	35·9	52	70	89	116	139
	0·89 2+								
Al	0·51 3+	5·97	18·8	28·5	120·0	153·6	190·3	243·2	285·8
Am	1·07 3+								
	0·92 4+								
As	0·58 3+	10·5	20	28·3	50·1	62·6	127·6	160	196
	0·46 5+								
At	0·62 7+	9·6	18	30	41	51	78	91	138
Au	1·37 1+	9·23	20·0	30	44	58	73	96	114
	0·85 3+								
B	0·23 3+	8·28	25·1	37·9	259·3	338·5			
Ba	1·34 2+	5·21	10·0	37	49	62	80	93	106
Be	0·35 2+	9·32	18·2	153·9	216·6				
Bi	0·96 3+	8·8	17	26·6	45	55·7	88	107	127
	0·74 5+								
Br	1·96 1−								
	0·47 5+	11·76	19·2	35·6	50·2	60	87	104	210
	0·39 7+								
C	0·16 4+	11·27	24·8	47·9	64·5	392·0	487		
Ca	0·99 2+	6·11	11·9	51·0	67	84·0	111	127	151
Cd	0·97 2+	8·99	16·9	38·1	55	73	94	115	146
Ce	1·07 3+	6·54			36·5	70	85	100	122
	0·94 4+								
Cl	1·81 1−								
	0·34 5+	12·90	23·7	39·9	53·5	67·8	97	114·3	346·6
	0·27 7+								
Co	0·72 2+	7·84	17·4	34	53	82	109	138	170
	0·63 3+								
Cr	0·89 2+	6·74	16·7	32	51	72	90	160·3	184
	0·63 3+								
	0·52 6+								
Cs	1·67 1+	3·89	23·4	34	46	62	74	86	117
Cu	0·96 1+	7·72	20·2	38	59	83	109	148	182
	0·72 2+								
Dy	0·92 3+	6·8							
Er	0·89 3+								

Table 2 (cont.)

Element	Radius for Charge	Ionization Potential							
		1	2	3	4	5	6	7	8
Eu	1·29 2+	5·64	11·2						
	0·98 3+								
F	1·33 1−								
	0·08 7+	17·43	34·9	62·7	87·3	114·3	157·2	185·2	953
Fe	0·74 2+	7·83	16·5	30	56	79	105	133	151·2
	0·64 3+								
Fr	1·80 1+		22	32	43	59	71	84	117
Ga	0·62 3+	5·97	20·5	30·8	63·9	90	118	149	183
Gd	0·97 3+	6·7							
Ge	0·73 2+	8·13	16·0	34·2	45·7	93·5	123	155	189
	0·53 4+								
H	1·54 1−	13·59							
Hf	0·78 4+		14·8	21	31				
Hg	1·27 1+	10·44	18·8	34	46	61	77	94	120
	1·10 2+								
Ho	0·91 3+								
I	2·20 1−								
	0·62 5+	10·44	19·0	31	42	52	77	90	169·9
	0·50 7+								
In	0·81 3+	5·79	18·9	27·9	57·9	77	98	121	144
Ir	0·68 4+	9·2	16	27	39	57	72	88	104
K	1·33 1+	4·34	31·7	45·5	60·6	83	101	120	155
La	1·14 3+	5·6	11·4	19·1	52	66	80	100	114
Li	0·68 1+	5·40	75·7	121·8					
Lu	0·85 3+								
Mg	0·66 2+	7·64	15·0	80·2	109·3	141·2	186·9	225·6	266·8
Mn	0·80 2+	7·43	15·64	34	53	76	101	119·3	195
	0·66 3+								
	0·60 4+								
	0·46 7+								
Mo	0·70 4+	7·06		27	46·0	61	67	133	153
	0·62 6+								
N	0·16 3+	14·55	29·6	47·4	77·4	97·9	555·9	663	
	0·13 5+								
NH_4	1·43 1+								
Na	0·97 1+	5·14	47·3	71·7	98·9	138·6	172·5	209·1	264·3
Nb	0·74 4+		13	25	38	50	106	125	145
	0·69 5+								
Nd	1·04 3+	6·3							

Table 2 (*cont.*)

Element	Radius for Charge	Ionization Potential							
		1	2	3	4	5	6	7	8
Ni	0·69 2+	7·63	18·2	36	56	79	113	143	176
Np	1·10 3+								
	0·95 4+								
	0·71 7+								
O	1·32 2−								
	0·10 6+	13·62	35·2	54·9	77·4	113·9	138·1	739·1	867
Os	0·88 4+	8·7	15	25	40	54	68	83	99
	0·69 6+								
P	0·44 3+	10·9	19·7	30·2	51·4	65·0	223	268	316
	0·35 5+								
Pa	1·13 3+						84	100	115
	0·98 4+								
	0·89 5+								
Pb	1·20 2+	7·42	15·0	31·9	42·1	69·4	84	103	122
	0·84 4+								
Pd	0·80 2+	8·1	19·8	33	49	66	90	111	132
	0·65 4+								
Pm	1·06 3+								
Po	0·67 6+	8·2	19	28	38	61	73	112	132
Pr	1·06 3+	5·8					89	106	122
	0·92 4+								
Pt	0·80 2+	8·9	18·5	29	41	55	75	92	109
	0·65 4+								
Pu	1·08 3+								
	0·93 4+								
Ra	1·43 2+	5·27	10·1	34	46	59	76	89	103
Rb	1·47 1+	4·17	27·3	39·7	53	71	86	102	134
Re	0·72 4+	8	13	26	38	51	65	79	
	0·56 7+								
Rh	0·68 3+	7·7	18	31	46	67	85	105	126
Ru	0·67 4+	7·5	16	29	47	63	81	100	119
S	1·74 2−								
	0·37 4+	10·36	23·4	35·1	47·1	72	88·1	281	328·9
	0·30 6+								
Sb	0·76 3+	8·64	17	24·9	44·2	55·7	107·7	132	157
	0·62 5+								
Sc	0·81 3+	6·7	12·8	24·8	73·6	91	110·5	141	158
Se	1·91 2−								
	0·83 3+	9·73	21	34	42·9	72·8	81·7	166	202
	0·50 4+								
	0·42 6+								

Table 2 (*cont.*)

Element	Radius for Charge	Ionization Potential							
		1	2	3	4	5	6	7	8
Si	0·42 4+	8·15	16·4	33·5	45·2	165·9	204·1	245·2	301·7
Sm	1·00 3+	5·6	11·4						
Sn	0·93 2+	7·30	14·6	30·7	39·4	80·9	103	126	151
	0·71 4+								
Sr	1·12 2+	5·69	11·0	43	57·0	72	93	109	126
Ta	0·68 5+			22	33	45			
Tb	0·93 3+	6·7							
	0·81 4+								
Tc	0·56 7+								
Te	2·11 2−								
	0·70 4+	8·96	19	30·6	37·8	60·3	72·4	137·3	164
	0·56 6+								
Th	1·02 4+				29·4	65	80	94	115
Ti	0·94 2+	6·84	13·6	27·6	43·3	99·4	119	140·1	176
	0·76 3+								
	0·68 4+								
Tl	1·47 1+	6·12	20·3	29·8	50	64	81	98	117
	0·95 3+								
Tm	0·87 3+								
U	0·97 4+	4						104	121
	0·80 6+								
V	0·88 2+	6·71	14·1	26·5	48	64·9	128·3	150	172·8
	0·74 3+								
	0·63 4+								
	0·59 5+								
W	0·70 4+	7·94		24	35	48	61		
	0·62 6+								
Y	0·92 3+	6·5	12·3	20·4	62	76·9	94	117	135
Yb	0·86 3+	6·22	12						
Zn	0·74 2+	9·39	18·0	40	62	86	114	144	188
Zr	0·79 4+	6·95	14	24·1	34·0	83	98·9	118	143

3 ELECTRON AFFINITIES OF THE ATOMS

The electron affinity of an atom or radical is the energy absorbed in converting the particular ion shown into the neutral atom or radical. Values under I are those given by PRITCHARD (*Chem. Rev.* 52 (1953) 529); values under II are those given in Landolt-Börnstein, I Band, 1 Teil, p. 213.

Ion	I kcal/mole	II kcal/mole	II eV	Ion	I kcal/mole	II kcal/mole	II eV
H^-	17·22	16·5	0·72	S^{2-}	−80	−90	−4
Li^-	12·5	10	0·5	Se^-	$\geqslant$40 ?		
Na^-	28			Se^{2-}	−97		
K^-	16			Te^-	50 ?		
Hg^-	35·4						
C^-	48 ± 20	28	1·2	F^-	83·5 ± 2	94	4·1
C^{4-}	−708			Cl^-	88·2 ± 1·5	87	3·78
N^-	−16			Br^-	81·6 ± 1·5	81	3·52
N^{3-}	$\geqslant$47 ?			I^-	74·6 ± 1·5	72	3·12
Bi^-	$\geqslant$17 ?			CN^-		70	3
O^-	53·8 ± 0·8	53·5	2·34	OH^-		45	2
O^{2-}	−210	−150	−6·5	HS^-		60	2·5
S^-	$\geqslant$24	60	2·5				

4 THE WORK OF EXTRACTION OF AN ELECTRON FROM VARIOUS METALS IN ELECTRON VOLTS

Ag	4·70	Cu	4·48	Nb	3·99	Si	3·59
Al	4·20	Fe	4·63	Nd	3·3	Sm	3·2
As	4·79	Ga	4·16	Ni	4·91	Sn	4·39
Au	4·71	Ge	4·62	Os	4·55	Sr	2·74
B	4·6	Hf	3·53	Pb	4·04	Ta	4·13
Ba	2·52	Hg	4·53	Pd	4·98	Te	4·73
Be	3·92	Ir	4·57	Pr	2·7	Th	3·47
Bi	4·34	K	2·25	Pt	5·36	Ti	4·16
C	4·36	La	3·3	Rb	2·13	Tl	4·05
Ca	3·20	Li	2·46	Re	4·97	U	3·45
Cd	4·04	Mg	3·70	Rh	4·65	V	4·11
Ce	2·88	Mn	3·95	Ru	4·52	W	4·53
Co	4·25	Mo	4·24	Sb	4·56	Zn	4·27
Cr	4·45	Na	2·28	Se	4·87	Zr	3·93
Cs	1·94						

Rearranged from Landolt-Börnstein, 6th Edn. Vol. I, part IV, pp. 759–61

5 LATTICE ENERGIES OF SALTS OF UNIVALENT CATIONS AT 18°C IN KCAL MOLE^{-1}

Cation	Anion											
	Br	Cl	CN	F	H	I	O	O_2	OH	S	Se	SH
Ag	212	215		228		211	713					
Cs	152·7	156·7	142·5	177·2	156	146·1		(156)	(176)			143
Cu	232	236				231	782			687	689	
K	159·8	166·2	156	198·5	165	152·3	(533)	(168)	(202)			155
Li	203·0	203·0		246·0	220	182·1	690					178
Na	177·1	184·7	171	217·4	193	167·3	(602)		234	529		168
NH_4	(154)	(161)	148	191		(145)			(168)			149
Rb	156·7	162·1	150	185·2	162	149·7	(513)	(162)	(184)			150
Tl	164	172				166						

Values in brackets are calculated on the basis of a theoretical model.

6 LATTICE ENERGIES OF SALTS OF POLYVALENT CATIONS AT 18°C IN KCAL MOLE^{-1}

Cation	Anion				
	Cl	F	O	S	Se
Al^{3+}			3609		
Ba^{2+}		564	741	661	632
Be^{2+}			1053	854	820
Ca^{2+}		629	823	727	696
Cd^{2+}		672	910	808	
Co^{2+}		708	945		
Cr^{3+}			4668		
Fe^{2+}		685	940		
Hg^{2+}				850	848
Mg^{2+}		698	913	790	734
Mn^{2+}		653	923	803	784
Ni^{2+}		712	960		
Pb^{2+}		599		737	
Pb^{4+}			2777		
Sn^{4+}			2780		
Sr^{2+}	515	597	781	695	667
Zn^{2+}	630	672	965	853	800

7 PHYSICAL PROPERTIES OF WATER

t°C	ρ	V	p	ϵ	$\eta \times 10^2$	$\tau \times 10^{12}$	$D_1^* \times 10^5$	$D_2^* \times 10^5$
0	0·99987	18·0235	4·579	87·740	1·792	17·7	1·00	1·33
5	0·99999	18·0213	6·543	85·763	1·519		1·20	1·58
10	0·99973	18·0260	9·209	83·832	1·308	12·6		
15	0·99913	18·0368	12·788	81·946	1·140		1·61	2·14
18	0·99862		15·477		1·056			
20	0·99823	18·0530	17·535	80·103	1·005	9·5		
25	0·99707	18·0741	23·756	78·304	$0{\cdot}893_7$		2·13	2·83
30	0·99568	18·0993	31·824	76·546	$0{\cdot}800_7$	7·4		
35	0·99406	18·1288	42·175	74·828	$0{\cdot}722_5$		2·76	3·55
40	$0{\cdot}9922_4$	18·1619	55·324	73·151	$0{\cdot}656_0$	5·9		
45	$0{\cdot}9902_4$	18·1988	71·88	71·512	$0{\cdot}598_8$		3·45	4·41
50	$0{\cdot}9880_7$	18·2387	92·51	69·910	$0{\cdot}549_4$	4·8		
55	$0{\cdot}9857_3$	18·2820	118·04	68·345	$0{\cdot}506_4$		4·16	5·41
60	$0{\cdot}9832_4$	18·3283	149·38	66·815	$0{\cdot}468_8$	4·0		
65	$0{\cdot}9805_9$	18·3779	187·54	65·319	$0{\cdot}435_5$			
70	$0{\cdot}9778_1$	18·4301	233·7	63·857	$0{\cdot}406_1$			
75	$0{\cdot}9748_9$	18·4853	289·1	62·427	$0{\cdot}379_9$	3·2		
80	$0{\cdot}9718_3$	18·5435	355·1	61·027	$0{\cdot}356_5$			
85	$0{\cdot}9686_5$	18·6044	433·6	59·659	$0{\cdot}335_5$			
90	$0{\cdot}9653_4$	18·6682	525·76	58·319	$0{\cdot}316_5$			
95	$0{\cdot}9619_2$	18·7346	633·90	57·007	$0{\cdot}299_4$			
100	$0{\cdot}9583_8$	18·8038	760·00	55·720	$0{\cdot}283_8$			

ρ— density in g ml^{-1}; V—molar volume in cm^3 mole^{-1}; p—vapour pressure in mm Hg; ϵ—dielectric constant; η—viscosity in poise; τ—dielectric relaxation time in sec; D_1^*—self-diffusion coefficient using D_2O in cm^2 sec^{-1}; D_2^*—self-diffusion coefficient using H_2O^{18} in cm^2 sec^{-1}

8 PROPERTIES OF SOME ORGANIC SOLVENTS

at 25°C (except where stated)

Solvent	t_f°C	t_b°C	ϵ	κ	η	ρ
CH_3OH	− 98	64·8	32·63	2×10^{-9}	0·00545	0·7866
$HCOOH$	8·4	100·8	57·0	6×10^{-5}	0·016376	1·22647
$HCONH_2$	2·55	114	109·5	$1{\cdot}98 \times 10^{-6}$	0·03359	1·1292
HCONHMe		180	182·4	8×10^{-7}	0·0165	0·9988
$HCONMe_2$	− 61	153	36·71	6×10^{-8}	0·00796	0·9442
CH_3CN	− 44·9	81·6	36·7	5×10^{-8}	0·00344	0·7767
CH_3COOH	16·6	118	9·7^d	4×10^{-9}	0·01232^c	1·04922^c
$CH_2Cl.CH_2Cl$	− 35·5	83·5	10·36	3×10^{-10}	0·00785	1·2453
$CHCl_2.CH_3$	− 96·9	57·3	10·00		0·00465	1·1667
$CH_2OH.CN$		183	68	$8{\cdot}4 \times 10^{-6}$		
CF_3COOH	− 15·3	72	39·5^c			
CH_2OHCH_2OH	− 12·3	197	37·7	$1{\cdot}16 \times 10^{-6}$	0·1733	1·11307^c
CH_3CH_2OH	−114	78·3	24·3	$1{\cdot}35 \times 10^{-9}$	0·0109	0·7851
$CH_3CH_2CH_2OH$	−126	97·2	20·1	$9{\cdot}17 \times 10^{-9d}$	0·0197	0·7998
CH_3COCH_3	− 95	56·1	20·70	$5{\cdot}5 \times 10^{-8}$	0·00304	0·7845
$CH_2OHCHOHCH_2OH$	18	290	42·5	9×10^{-8}	10·69^c	1·26108^c
$1:4\ C_4H_4O_2$	11·65	101·3	2·209	5×10^{-15}	0·01196	1·0280
C_5H_5N	− 42	115·5	12·3	1×10^{-7}	0·00882	0·9779
C_6H_6	5·4	80·1	2·275	5×10^{-17}	0·00606	0·87368
$C_6H_5NO_2$	5·77	209·6	34·82	$1{\cdot}22 \times 10^{-8}$	0·01811	1·1986
$o\text{–}NO_2C_6H_4NH_2$	71·5		34·5^b			
$p\text{–}NO_2C_6H_4NH_2$	148	331	56·3^a			
$C_6H_{11}OH$	− 24	161·5	15·0			

t_f—freezing point; t_b—boiling point; ϵ—dielectric constant; κ—specific conductivity in ohm^{-1} cm^{-1}; η—viscosity in poise; ρ—density.
a 160°C; b 90°C; c 20°C; d 18°C

9 DIELECTRIC CONSTANTS OF MIXTURES OF WATER AND ORGANIC SOLVENTS AT 25°C

Non-aqueous Component	Weight % of Non-aqueous Component									
	10	20	30	40	50	60	70	80	90	100
CH_3CH_2OH	72·8	67·0	61·1	55·0	49·0	43·4	38·0	32·8	28·1	24·3
$CH_3CH_2CH_2OH$	71·8	64·9	57·7	50·3	43·0	36·4	30·7	26·1	22·7	20·1
$(CH_3)_2CHOH$	71·4	64·1	56·9	49·7	42·5	35·3	28·7	23·7	20·3	18·0
$(CH_3)_3COH$	70·0	61·3	52·6	43·9	35·4	27·9	21·4	16·5	12·4	9·9
$CH_2OH.CH_2OH$	75·6	72·8	69·8	66·6	63·2	59·4	54·7	49·3	43·7	37·7
$CH_2OH.CHOHCH_2OH$	75·5	72·9	70·0	67·1	64·0	60·0	55·6	50·6	45·5	40·1
CH_3COCH_3	73·0	67·0	61·0	54·6	48·2	41·8	35·7	29·6	24·0	19·1
Mannitol	77·1	75·5								
Sucrose	76·3	73·6	70·9	67·9	64·2	59·9	54·2			
1:4:Dioxan	69·69	60·79	51·90	42·98	34·26	25·85	17·69	10·71	5·605	2·101

10 DIELECTRIC CONSTANTS OF METHANOL + WATER MIXTURES FROM 5°C TO 55°C

Weight % Methanol	Temperature °C					
	5	15	25	35	45	55
10	81·68	77·83	74·18	70·68	67·32	64·08
20	77·38	73·59	69·99	66·52	63·24	60·06
30	72·80	69·05	65·55	62·20	58·97	55·92
40	67·91	64·31	60·94	57·72	54·62	51·69
50	62·96	59·54	56·28	53·21	50·29	47·53
60	57·92	54·71	51·67	48·76	46·02	43·42
70	52·96	49·97	47·11	44·42	41·83	39·38
80	48·01	45·24	42·60	40·08	37·70	35·46
90	42·90	40·33	37·91	35·65	33·53	31·53
95	39·98	37·61	35·38	33·28	31·29	29·43
100	36·88	34·70	32·66	30·74	28·92	27·21

11 PARAMETERS FOR THE EQUATION LOG$_{10}$ $\epsilon = A - Bt$

expressing the dielectric constant of 1:4: Dioxan + water mixtures from $t = 0°C$ to $t = 80°C$

Reproduced from HARNED and OWEN, *Physical Chemistry of Electrolyte Solutions*, First Edition by courtesy of Reinhold Book Division

Weight % Dioxan	A	$B \times 10^3$
10	1·8969	2·15
20	1·8398	2·24
30	1·7734	2·33
40	1·6935	2·41
50	1·5965	2·47
60	1·4747	2·49
70	1·3090	2·45
80	1·0860	2·25
90	0·7896	1·64
95	0·5923	1·00
100	0·3234	0·04

12 DIELECTRIC CONSTANTS (ϵ) OF SOME INORGANIC SOLVENTS

Reproduced from Harned and Owen, *Physical Chemistry of Electrolyte Solutions*, First Edition, by courtesy of Reinhold Book Division

Solvent	ϵ	t°C	Solvent	ϵ	t°C
$AsCl_3$	12·8	20	NH_3	16·9	25
D_2O	77·94	25	N_2H_2	51·7	25
HCN	106·8	25	N_2O_4	2·4	18
HF	83·6	25	NOCl	18·2	12
H_2SO_4	101	25	$POCl_3$	13·3	22
$HgBr_2$	9·8	240	SO_2	14·1	20
I_2	11·1	118	$SOCl_2$	9·25	20
IF_5	36·2	25	SO_2Cl_2	9·2	20
			$SeOCl_2$	46·2	20

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13 THEORETICAL COEFFICIENTS FOR UNI-UNI-VALENT ELECTROLYTES IN WATER AND VALUES OF $RT \ln 10/F$

t°C	$\mathfrak{S}_{(f)}$	$A'/\mathring{a}$	$\mathfrak{S}_{(v)}$	$-W_{(v)}/\mathring{a}$	$\mathfrak{S}_{(H)}$	$-W_{(H)}/\mathring{a}$	h	$\mathfrak{S}_{(Cp)}$	$\mathfrak{S}_{(K)}$	$\mathfrak{S}_{(E)}$
0	0·4883	0·3241	3·700	0·1189	509·2	57·45	−0·0222	6·520	0·00165	−0·0050
5	0·4921	0·3249	3·684	0·1186	543·4	58·25	+0·0051	7·123	0·00159	−0·0015
10	0·4960	0·3258	3·685	0·1190	580·4	59·56	0·0275	7·657	0·00155	+0·0016
15	0·5002	0·3267	3·701	0·1199	620·2	61·30	0·0462	8·164	0·00152	0·0045
18	0·5028	0·3273	3·718	0·1206	645·3	62·54	0·0559	8·469	0·00151	0·0061
20	0·5046	0·3276	3·732	0·1212	662·6	63·40	0·0619	8·674	0·00151	0·0071
25	0·5091	0·3286	3·776	0·1230	707·7	65·86	0·0752	9·194	0·00151	0·0096
30	0·5139	0·3297	3·833	0·1252	755·5	68·64	0·0866	9·731	0·00151	0·0120
35	0·5189	0·3307	3·902	0·1279	806·2	71·70	0·0966	10·300	0·00153	0·0143
40	0·5241	0·3318	3·982	0·1310	860·0	75·07	0·1054	10·922	0·00155	0·0166
45	0·5295	0·3330	4·075	0·1345	917·1	78·78	0·1130	11·606	0·00158	0·0189
50	0·5351	0·3341	4·180	0·1385	978·1	82·87	0·1196	12·365	0·00162	0·0212
55	0·5410	0·3353	4·297	0·1428	1043·2	87·33	0·1255	13·208	0·00167	0·0236
60	0·5470	0·3366	4·427	0·1477	1112·8	92·24	0·1306	14·142	0·00172	0·0260
65	0·5534	0·3379	4·569	0·1530	1187·6	97·63	0·1350	15·185	0·00179	0·0285
70	0·5599	0·3392	4·725	0·1589	1268·1	103·46	0·1389	16·354	0·00186	0·0312
75	0·5668	0·3406	4·895	0·1655	1355·2	110·11	0·1422	17·673	0·00195	0·0339
80	0·5739	0·3420	5·079	0·1722	1449·4	117·34	0·1449	19·169	0·00204	0·0368
85	0·5813	0·3435	5·279	0·1797	1551·8	125·35	0·1472	20·851	0·00215	0·0398
90	0·5891	0·3450	5·495	0·1879					0·00226	
95	0·5972	0·3466	5·728	0·1968					0·00239	
100	0·6056	0·3482	5·979	0·2064					0·00254	
	w'	w''	$\nu w'/2$	$\nu w'w''/2$	$\nu w'/2$	$\nu w'w''/2$	1	$\nu w'/2$	$\nu w'/2$	$\nu w'/2$

Table 13 (*cont.*)

t°C	α^*	β^*	$RT \ln 10/F$ abs. volt	$RT \ln 10/F$ int. volt
0	0·2195	29·61	0·054195	0·054179
5	0·2212	35·07	0·055187	0·055171
10	0·2230	40·77	0·056179	0·056163
15	0·2249	46·78	0·057171	0·057154
18	0·2261	50·59	0·057766	0·057749
20	0·2268	53·24	0·058163	0·058146
25	0·2289	60·19	0·059155	0·059138
30	0·2311	67·51	0·060147	0·060129
35	0·2333	75·21	0·061139	0·061121
40	0·2356	83·21	0·062131	0·062113
45	0·2381	91·41	0·063123	0·063105
50	0·2406	99·72	0·064115	0·064096
55	0·2432	108·37	0·065107	0·065088
60	0·2460	117·41	0·066099	0·066080
65	0·2488	126·79	0·067091	0·067071
70	0·2517	136·58	0·068083	0·068063
75	0·2548	146·68	0·069075	0·069055
80	0·2580	157·03	0·070067	0·070046
85	0·2614	167·71	0·071059	0·071038
90	0·2649	178·61	0·072051	0·072030
95	0·2685	189·74	0·073043	0·073022
100	0·2723	201·04	0·074035	0·074013
	$w'Q$	w^*		

z = valency
ν = total number of ions produced in dissociation of one molecule
$\mathring{a}$ = distance of closest approach of ions in angström units
c = concentration in moles per litre of solution
ν_j = number of ions of species j
$\lambda_i°$ = limiting ionic conductance
p = total number of ionic species in solution

LIMITING EQUATIONS FROM THE DEBYE-HÜCKEL THEORY IN WHICH THE COEFFICIENTS OF TABLE 13 ARE USED

(1) Mean activity coefficient

$$\log_{10} f_{\pm} = -\mathfrak{S}_{(f)}\sqrt{c}/(1+A'\sqrt{c})$$

(2) Partial molal volume (cm³ mole⁻¹)

$$\bar{V}_2 - \bar{V}_2^\circ = \mathfrak{S}_{(v)}\sqrt{c}/(1+A'\sqrt{c}) + W_{(v)}c/(1+A'\sqrt{c})^2$$

(3) Relative partial molal heat content (cal mole⁻¹)

$$\bar{L}_2 - \bar{L}_2^\circ = \mathfrak{S}_{(H)}\sqrt{(c)}/(1+A'\sqrt{c}) + W_{(H)}c/(1+A'\sqrt{c})^2$$

(4) Relative partial molal heat capacity (cal deg⁻¹ mole⁻¹)

$$\bar{J}_2 = \bar{C}_{p2} - \bar{C}_{p2}^\circ = \mathfrak{S}_{(cp)}\sqrt{c}$$

(5) Partial molal compressibility (cm³ bar⁻¹ mole⁻¹)

$$\bar{K}_2 - \bar{K}_2^\circ = \mathfrak{S}_{(K)}\sqrt{c}$$

(6) Partial molal expansibility (cm³ deg⁻¹ mole⁻¹)

$$\bar{E}_2 - \bar{E}_2^\circ = \mathfrak{S}_{(E)}\sqrt{c}$$

(7) Equivalent conductance (ohm⁻¹ cm²)

$$\Lambda = \Lambda^\circ - (\alpha^*\Lambda^\circ + \beta^*)\sqrt{c}$$

[a] For electrolytes of higher valence types, multiply the figures by the valence factor given at the bottom of the column, where

$$w' \equiv \frac{1}{\nu\sqrt{2}}\left(\sum_1^p \nu_j z_j^2\right)^{3/2} \qquad w'' \equiv \left(\frac{1}{2}\sum_1^p \nu_j z_j^2\right)^{1/2}$$

$$w^* = \left(\frac{|z_1|+|z_2|}{2}\right)\left(\frac{\nu|z_1 z_2|}{2}\right)^{1/2} \qquad Q = \frac{q^*}{0{\cdot}2929(1+\sqrt{q^*})}$$

$$q^* = \frac{|z_1 z_2|(\lambda^\circ_1 + \lambda^\circ_2)}{(|z_1|+|z_2|)(|z_2|\lambda^\circ_1 + |z_1|\lambda^\circ_2)}$$

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14 THE PARAMETER σ FOR USE IN EQUATIONS FOR EXTRAPOLATION OF APPARENT MOLAL VOLUMES AND APPARENT MOLAL HEAT CONTENTS

Namely: $\phi_V - \phi_V^\circ = \frac{2}{3}\mathfrak{S}_{(V)}\Omega_{(V)}\sqrt{c} + \frac{1}{2}K_{(V)}c$ and $\phi_{(H)} - \phi_H^\circ = \frac{2}{3}\mathfrak{S}_{(H)}\Omega_{(H)}\sqrt{c} + \frac{1}{2}K_{(H)}c$ where $\Omega_{(V)} = [1{\cdot}3513/(1+\kappa a)] - 0{\cdot}3513\sigma$ and $\Omega_{(H)} = [(1+h)/(1+\kappa a)] - h\sigma$. These are developments of Equations 2 and 3 above respectively. (h is given in Table 13) $K_{(V)}$ and $K_{(H)}$ are determined in the extrapolation.

Values of $\sigma \equiv (3/x^3)[1 + x - (1+x)^{-1} - 2\ln(1+x)]$ where $x = A'\sqrt{c}$

x	0·00	0·01	0·02	0·03	0·04	0·05	0·06	0·07	0·08	0·09
0·00	1·000000	0·985178	0·970704	0·956568	0·942758	0·929263	0·916074	0·903182	0·890577	0·872250
0·10	0·866193	0·854399	0·842859	0·831565	0·820510	0·809687	0·799090	0·788712	0·778547	0·768589
0·20	0·758832	0·749271	0·739900	0·730714	0·721707	0·712876	0·704216	0·695721	0·687388	0·679212
0·30	0·671189	0·663316	0·655588	0·648002	0·640554	0·633241	0·626060	0·619007	0·612078	0·605272
0·40	0·598585	0·592014	0·585557	0·579210	0·572971	0·566838	0·560809	0·554880	0·549049	0·543315
0·50	0·537675	0·532127	0·526668	0·521298	0·516014	0·510813	0·505695	0·500657	0·495699	0·490817
0·60	0·486010	0·481278	0·476617	0·472028	0·467507	0·463055	0·458669	0·454348	0·450091	0·445896
0·70	0·441763	0·437689	0·433675	0·429718	0·425817	0·421972	0·418182	0·414444	0·410759	0·407125
0·80	0·403542	0·400008	0·396522	0·393083	0·389692	0·386346	0·383045	0·379788	0·376574	0·373403
0·90	0·370273	0·367185	0·364137	0·361128	0·358158	0·355226	0·352332	0·349475	0·346654	0·343868
1·00	0·341117		0·335718		0·330451		0·325313		0·320299	
1·10	0·315405		0·310627		0·305962		0·301405		0·296953	
1·20	0·292604		0·288353		0·284198		0·280136		0·276164	
1·30	0·272279		0·268479		0·264761		0·261123		0·257562	
1·40	0·254077		0·250665		0·247323		0·244051		0·240846	
1·50	0·237705		0·234628		0·231613		0·228658		0·225761	
1·60	0·222921		0·220136		0·217405		0·214727		0·212099	
1·70	0·209521		0·206992		0·204510		0·202073		0·199682	
1·80	0·197335		0·195030		0·192766		0·190543		0·188360	
1·90	0·186216		0·184109		0·182039		0·180005		0·178006	

Table 14 (*cont.*)

x	σ	x	σ	x	σ
2·00	0·176041	3·00	0·108601	4·00	0·074115
2·05	0·171274	3·05	0·106333	4·05	0·072853
2·10	0·166704	3·10	0·104138	4·10	0·071623
2·15	0·162321	3·15	0·102011	4·15	0·070425
2·20	0·158114	3·20	0·099951	4·20	0·069257
2·25	0·154074	3·25	0·097955	4·25	0·068119
2·30	0·150191	3·30	0·096019	4·30	0·067009
2·35	0·146458	3·35	0·094142	4·35	0·065927
2·40	0·142867	3·40	0·092320	4·40	0·064871
2·45	0·139410	3·45	0·090553	4·45	0·063842
2·50	0·136082	3·50	0·088837	4·50	0·062837
2·55	0·132875	3·55	0·087170		
2·60	0·129783	3·60	0·085551		
2·65	0·126801	3·65	0·083979		
2·70	0·123924	3·70	0·082450		
2·75	0·121147	3·75	0·080963		
2·80	0·118464	3·80	0·079518		
2·85	0·115872	3·85	0·078112		
2·90	0·113367	3·90	0·076743		
2·95	0·110945	3·95	0·075412		

κ = Debye-Hückel characteristic reciprocal length:

$$\kappa^2 = (4\pi e_0^2/\epsilon \boldsymbol{k}T) \sum_i{}' n_i z_i^2$$

e_0 = electronic charge
ϵ = dielectric constant
n_i = number of ions of species i per unit volume

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15 THE FUOSS EXTRAPOLATION FUNCTION $F(z)$

z	0·000	0·001	0·002	0·003	0·004	0·005	0·006	0·007	0·008	0·009	Diff.
0·000	$1{\cdot}0000_0$	$0{\cdot}9990_0$	$0{\cdot}9980_0$	$0{\cdot}9970_0$	$0{\cdot}9959_9$	$0{\cdot}9949_9$	$0{\cdot}9939_8$	$0{\cdot}9929_7$	$0{\cdot}9919_7$	$0{\cdot}9909_6$	10_0
0·010	9899_5	9889_4	9879_3	9869_1	9859_0	9848_9	9838_7	9828_5	9818_4	9808_2	10_2
0·020	9798_0	9787_7	9777_5	9767_2	9757_0	9746_8	9736_5	9726_3	9716_0	9705_6	10_3
0·030	9695_3	9685_0	9674_7	9664_4	9654_0	9643_7	9633_3	9622_9	9612_5	9602_1	10_4
0·040	9591_6	9581_2	9570_8	9560_3	9549_8	9539_4	9528_9	9518_4	9507_8	9497_3	10_5
0·050	9486_7	9476_2	9465_6	9455_0	9444_4	9433_8	9423_2	9412_6	9401_9	9391_2	10_6
0·060	9380_5	9369_8	9359_1	9348_3	9337_6	9326_8	9316_1	9305_3	9294_6	9283_8	10_7
0·070	9273_1	9262_3	9251_4	9240_6	9229_7	9218_8	9207_9	9197_0	9186_1	9175_2	10_9
0·080	9164_3	9153_4	9142_4	9131_4	9120_4	9109_4	9098_4	9087_3	9076_3	9065_3	11_0
0·090	9054_2	9043_1	9031_9	9020_8	9009_6	8998_5	8987_3	8976_1	8964_9	8953_7	11_2
0·100	8942_5	8931_2	8919_9	8908_6	8897_3	8886_0	8874_7	8863_4	8852_1	8840_8	11_3
0·110	8829_4	8818_0	8806_5	8795_0	8783_5	8772_0	8760_5	8749_0	8737_5	8726_0	11_5
0·120	8714_5	8702_9	8691_3	8679_7	8668_1	8656_5	8644_8	8633_1	8621_4	8609_7	11_7
0·130	8598_0	8586_2	8574_4	8562_6	8550_8	8539_0	8527_2	8515_4	8503_5	8491_6	11_8
0·140	8479_7	8467_7	8455_7	8443_7	8431_7	8419_7	8407_7	8395_7	8383_6	8371_5	12_0
0·150	8359_4	8347_2	8335_0	8322_8	8310_6	8298_4	8286_2	8274_0	8261_7	8249_4	12_2
0·160	8237_1	8224_7	8212_3	8199_9	8187_5	8175_1	8162_6	8150_1	8137_6	8125_1	12_5
0·170	8112_6	8100_0	8087_4	8074_8	8062_1	8049_4	8036_7	8024_0	8011_3	7998_5	12_7
0·180	7985_7	7972_8	7959_9	7947_0	7934_1	7921_2	7908_3	7895_4	7882_4	7869_4	12_9
0·190	7856_4	7843_3	7830_2	7817_1	7803_9	7790_7	7777_5	7764_3	7751_0	7737_7	13_2
0·200	7724_4	7711_0	7697_6	7684_1	7670_6	7657_1	7643_6	7630_1	7616_6	7603_1	13_5

Fuoss solved the conductance equation $\Lambda = \gamma(\Lambda^\circ - A\sqrt{c\gamma})$ in the form $F(z)/\Lambda = (c\Lambda f_\pm^{\,2}/F(z))(1/K\Lambda^{\circ 2}) + 1/\Lambda^\circ$ where $z = A(\Lambda^\circ)^{-3/2}\sqrt{c\Lambda}$, $A = \alpha^*\Lambda^\circ + \beta^*$, γ is the fraction of the electrolyte existing as free ions and K is its dissociation constant. c = molarity (moles solute per 1000 ml solution).

16 THE SHEDLOVSKY EXTRAPOLATION FUNCTION $S(z)$

z	0·000	0·001	0·002	0·003	0·004	0·005	0·006	0·007	0·008	0·009	Diff.
0·000	1·0000	1·0010	1·0020	1·0030	1·0040	1·0050	1·0060	1·0070	1·0080	1·0090	10
0·010	1·0101	1·0111	1·0121	1·0131	1·0141	1·0151	1·0161	1·0171	1·0182	1·0192	10
0·020	1·0202	1·0212	1·0222	1·0233	1·0243	1·0253	1·0263	1·0274	1·0284	1·0294	10
0·030	1·0305	1·0315	1·0325	1·0335	1·0346	1·0356	1·0367	1·0377	1·0387	1·0398	10
0·040	1·0408	1·0418	1·0429	1·0439	1·0450	1·0460	1·0471	1·0481	1·0492	1·0502	11
0·050	1·0513	1·0523	1·0534	1·0544	1·0555	1·0565	1·0576	1·0586	1·0597	1·0608	11
0·060	1·0618	1·0629	1·0640	1·0650	1·0661	1·0671	1·0682	1·0693	1·0704	1·0714	11
0·070	1·0725	1·0736	1·0746	1·0757	1·0768	1·0779	1·0789	1·0800	1·0811	1·0822	11
0·080	1·0833	1·0843	1·0854	1·0865	1·0876	1·0887	1·0898	1·0909	1·0920	1·0930	11
0·090	1·0941	1·0952	1·0963	1·0974	1·0985	1·0996	1·1007	1·1018	1·1029	1·1040	11
0·100	1·1051	1·1062	1·1073	1·1084	1·1095	1·1107	1·1118	1·1129	1·1140	1·1151	11
0·110	1·1162	1·1173	1·1184	1·1196	1·1207	1·1218	1·1229	1·1240	1·1252	1·1263	11
0·120	1·1274	1·1285	1·1297	1·1308	1·1319	1·1331	1·1342	1·1353	1·1365	1·1376	11
0·130	1·1387	1·1399	1·1410	1·1421	1·1433	1·1444	1·1456	1·1467	1·1479	1·1490	11
0·140	1·1501	1·1513	1·1524	1·1536	1·1547	1·1559	1·1570	1·1582	1·1594	1·1605	12
0·150	1·1617	1·1628	1·1640	1·1652	1·1663	1·1675	1·1686	1·1698	1·1710	1·1721	12
0·160	1·1733	1·1745	1·1757	1·1768	1·1780	1·1792	1·1803	1·1815	1·1827	1·1839	12
0·170	1·1851	1·1862	1·1874	1·1886	1·1898	1·1910	1·1922	1·1934	1·1945	1·1957	12
0·180	1·1969	1·1981	1·1993	1·2005	1·2017	1·2029	1·2041	1·2053	1·2065	1·2077	12
0·190	1·2089	1·2101	1·2113	1·2125	1·2137	1·2149	1·2161	1·2174	1·2186	1·2198	12
0·200	1·2210	1·2222	1·2234	1·2246	1·2259	1·2271	1·2283	1·2295	1·2308	1·2320	12

Shedlovsky solved the conductance equation $\Lambda = \theta\Lambda^\circ - A(\Lambda/\Lambda^\circ)\sqrt{c\theta}$ in the form $[\Lambda S(z)]^{-1} = c\Lambda f_\pm^2 S(z)/K\Lambda^{\circ 2} + 1/\Lambda^\circ$ where θ is the degree of dissociation. c = molarity (moles solute per 1000 ml solution). z is defined as in Table 3.

17 BJERRUM'S FUNCTION

b	$\log_{10} Q(b)$	b	$\log_{10} Q(b)$
2	$-\infty$	20	3·59
2·5	$-0·728$	25	5·35
3	$-0·489$	30	7·19
4	$-0·260$	35	9·08
5	$-0·113$	40	11·01
6	$+0·016$	45	12·99
7	0·152	50	14·96
8	0·300	55	16·95
9	0·470	60	18·98
10	0·665	65	21·02
12	1·125	70	23·05
14	1·680	75	25·01
16	2·275	80	27·15
18	2·92		

According to Bjerrum's theory, the dissociation constant is given by

$$\kappa^{-1} = (4\pi N/1000)(|z_1z_2|e_0^2/k\epsilon T)^3 Q(b)$$

where $\qquad b = |z_1z_2|e_0^2/a\epsilon kT$

where N = Avogadro number, e_0 = charge on an electron, k = Boltzmann's constant, ϵ = dielectric constant, and a = distance of closest approach of ions in cm.

18 EXTENDED TERMS OF THE DEBYE-HÜCKEL THEORY

κa	$A(\kappa a)$	$B(\kappa a)$	$C(\kappa a)$	$D(\kappa a)$
0	0·00000	0·00000	0·000000	0·000000
0·005	0·00092	0·00107	0·001482	0·000009
0·01	0·00351	0·00416	0·004797	0·000071
0·02	0·01239	0·01487	0·014784	0·000423
0·03	0·02497	0·02985	0·027666	0·001264
0·04	0·04014	0·04725	0·042363	0·002693
0·05	0·05711	0·06564	0·058209	0·004750
0·06	0·07522	0·08394	0·074748	0·007457
0·07	0·09403	0·10138	0·091660	0·010809
0·08	0·11316	0·11737	0·108703	0·014766
0·09	0·13231	0·13153	0·125699	0·019291
0·10	0·15130	0·14363	0·142514	0·024335
0·11	0·16992	0·15356	0·15905	0·02986
0·12	0·18802	0·16126	0·17522	0·03580
0·13	0·20355	0·16680	0·19097	0·04211
0·14	0·22240	0·17023	0·20626	0·04874
0·15	0·23853	0·17166	0·22105	0·05563
0·16	0·25391	0·17123	0·23533	0·06274
0·17	0·26851	0·16910	0·24908	0·07002
0·18	0·28231	0·16543	0·26230	0·07743
0·19	0·29530	0·16037	0·27497	0·08493
0·20	0·30750	0·15409	0·28710	0·09248
0·21	0·31892	0·14674	0·29870	0·10005
0·22	0·32953	0·13847	0·30977	0·10761
0·23	0·33943	0·12942	0·32032	0·11513
0·24	0·34859	0·11973	0·33036	0·12258
0·25	0·35703	0·10953	0·33991	0·12994
0·26	0·36478	0·09895	0·34896	0·13720
0·27	0·37187	0·08804	0·35755	0·14433
0·28	0·37832	0·07696	0·36567	0·15132
0·29	0·38416	0·06577	0·37335	0·15816
0·30	0·38942	0·05453	0·38060	0·16482
0·31	0·39411	0·04335	0·38743	0·17132
0·32	0·39827	0·03222	0·39386	0·17762
0·33	0·40193	0·02131	0·39990	0·18374
0·34	0·40510	0·01053	0·40557	0·18965
0·35	0·40780	$+0·00001$	0·41087	0·19536
0·36	0·41007	$-0·01027$	0·41583	0·20087
0·37	0·41193	$-0·02022$	0·42045	0·20617
0·38	0·41339	$-0·02986$	0·42475	0·21116
0·39	0·41448	$-0·03917$	0·42875	0·21613
0·40	0·41525	$-0·0481$	0·43244	0·22080

Equations for the extended Debye-Hückel theory:

(*a*) Symmetrical electrolytes

$$\ln f_\pm = e_0^2 z^2 \kappa/[2\epsilon kT(1+\kappa a)] - (e_0^2 z^2/10\epsilon kTa)^3 A(\kappa a) - (e_0^2 z^2/10\epsilon kTa)^5 B(\kappa a).$$

(*b*) Unsymmetrical electrolytes

$$\begin{aligned}\ln f_\pm = &-|z_1z_2|e_0^2\kappa/[2\epsilon kT(1+\kappa a)] + |z_1z_2|\{(z_1+z_2)^2(e_0^2/10\epsilon kTa)^2 C(\kappa a)\\ &+ (z_1^2 - |z_1z_2| + z_2^2)(z_1+z_2)^2(e_0^2/10\epsilon kTa)^3 D(\kappa a)\\ &- (z_1^2 - |z_1z_2| + z_2^2)(e_0^2/10\epsilon kTa)^3 A(\kappa a)\}.\end{aligned}$$

19 STOICHIOMETRIC MEAN MOLAL ACTIVITY COEFFICIENTS FOR AQUEOUS INORGANIC ELECTROLYTES AT 25° C

Osmotic coefficients for aqueous solutions of many of the salts listed in Tables 19–21 are given by ROBINSON, R. A. and STOKES, R. H., *Electrolyte Solutions*, Butterworths, London, 1955.

Molality		0·001	0·002	0·005	0·01	0·02	0·05	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9	1·0	1·2	1·4	1·6	1·8	2·0	2·5	3·0
Salt																								
$AgClO_3$	a				0·904			0·767																
$AgNO_3$	b			0·925	0·897	0·860	0·793	0·734	0·657	0·606	0·567	0·536	0·509	0·485	0·464	0·446	0·429	0·399	0·374	0·352	0·333	0·316	0·280	0·252
$AlCl_3$	c						0·447	0·337	0·305	0·302	0·313	0·331	0·356	0·388	0·429	0·479	0·539	0·701	0·936	1·284	1·819			
$Al(ClO_3)_3$	d	0·78	0·72	0·62	0·53	0·45	0·35	0·30	0·27			0·26		0·29										
$Al(NO_3)_3$	e							0·204	0·157		0·140		0·148				0·190					0·45		1·02
$Al_2(SO_4)_3$	f							0·035	0·023	0·018	0·015	0·014	0·014	0·014	0·015	0·016	0·018							
$BaBr_2$	g			0·800	0·740		0·594	0·513	0·465	0·446	0·437	0·435	0·438	0·442	0·448	0·458	0·469	0·496	0·529	0·566	0·609	0·656		
$BaCl_2$	b	0·881	0·840	0·774	0·716	0·651	0·564	0·500	0·444	0·419	0·405	0·397	0·391	0·391	0·391	0·392	0·395	0·405	0·419	0·433	0·499			
BaI_2	f							0·542	0·509	0·502	0·510	0·523	0·540	0·562	0·587	0·617	0·649	0·724	0·814	0·924	1·055	1·221		
$Ba(NO_3)_2$	b	0·882	0·842	0·772	0·705	0·629	0·517	0·428	0·342	0·293	0·260													
$Ba(OH)_2$	a		0·853	0·773	0·712	0·627	0·526	0·443	0·370	$(m=0·2296, \gamma=0·358)$														
$BeSO_4$	c							0·150	0·109	·0885	·079	·0692	·0639	·0600	·0570	·0546	·0530	·0506	·0493	·0488	·0490	·0497	·0538	·0613
$CaBr_2$	f							0·532	0·492	0·482	0·483	0·491	0·505	0·522	0·543	0·568	0·597	0·665	0·747	0·848	0·970	1·121	1·657	2·54
$CaCl_2$	g	0·889	0·852	0·789	0·731	0·668	0·583	0·518	0·472	0·455	0·448	0·448	0·453	0·460	0·470	0·484	0·500	0·539	0·587	0·644	0·712	0·792	1·063	1·483
$Ca(HCO_3)_2$	h	0·96	0·94	0·91	0·88	0·83																		
CaI_2	f							0·560	0·531	0·531	0·543	0·561	0·584	0·614	0·650	0·692	0·741	0·852	0·992	1·161	1·375	1·640		
$Ca(NO_3)_2$	b	0·88	0·84	0·77	0·71	0·64	0·545	0·485	0·426	0·395	0·376	0·363	0·354	0·347	0·342	0·338	0·336	0·335	0·335	0·337	0·340	0·345	0·360	0·380
CaS_2O_3	d	0·754	0·674	0·540	0·446	0·364	0·267	0·208	0·163			0·122					0·111	$(m=1·26, \gamma=0·120)$						
$CdBr_2$	g	0·787	0·699	0·570	0·468	0·370	0·259	0·190	0·132	0·105	0·089	·0780	·0699	·0638	·0591	·0551	·0518	·0468	·0431	·0402	·0380	·0361	·0328	·0305
$CdCl_2$	g	0·819	0·743	0·623	0·524	0·456	0·304	0·228	0·164	0·133	0·114	0·101	·0905	·0827	·0765	·0713	·0669	·0599	·0546	·0504	·0469	·0441	·0381	·0352
CdI_2	g			0·490	0·379	0·281	0·167	0·106	·0685	·0523	·0433	·0376	·0337	·0307	·0285	·0267	·0251	·0228	·0214	·0199	·0189	·0180	·0168	
$Cd(NO_3)_2$	f							0·513	0·464	0·442	0·430	0·425	0·423	0·423	0·425	0·428	0·433	0·446	0·460	0·478	0·495	0·515	·0570	
$CdSO_4$	b	0·726	0·639	0·505	0·399	0·307	0·206	0·150	0·102	0·082	0·069	0·061	0·055	0·050	0·046	0·043	0·041	0·038	0·035	0·034	0·032	0·032	0·032	0·033
$CeCl_3$	g	0·788	0·726	0·632	0·553	0·478	0·388	0·309	0·273	0·261	0·260	0·264	0·272	0·286	0·302	0·320	0·342	0·395	0·469	0·559	0·684	0·847		
$Ce_2(SO_4)_3$	a				0·171	0·112	0·063	0·041																
$CoBr_2$	f							0·546	0·513	0·509	0·517	0·532	0·554	0·580	0·612	0·648	0·690	0·789	0·914	1·069	1·255	1·478	2·25	3·42
$CoCl_2$	f							0·522	0·479	0·463	0·459	0·462	0·470	0·479	0·492	0·511	0·531	0·578	0·634	0·699	0·773	0·860	1·120	1·458
CoI_2	c							0·58	0·56	0·57	0·59	0·62	0·66	0·71	0·77	0·84	0·91	1·09	1·31	1·59	1·95	2·4	4·4	7·7
$Co(NO_3)_2$	f							0·518	0·471	0·452	0·445	0·445	0·448	0·455	0·465	0·477	0·490	0·523	0·563	0·609	0·664	0·726	0·920	1·182
$CrCl_3$	c							0·331	0·298	0·294	0·300	0·314	0·335	0·362	0·397	0·436	0·481	0·584						
$Cr(NO_3)_3$	c							0·319	0·285	0·279	0·281	0·291	0·304	0·322	0·344	0·371	0·401	0·474	0·565					
$Cr_2(SO_4)_3$	c							·0458	·0300	·0238	·0207	·0190	·0182	·0181	·0185	·0194	·0208	·0250						
$CsBr$	f							0·754	0·694	0·654	0·626	0·603	0·586	0·571	0·558	0·547	0·538	0·523	0·510	0·500	0·493	0·486	0·474	0·465
$CsCl$	b			0·92	0·90	0·86	0·809	0·756	0·694	0·656	0·628	0·606	0·589	0·575	0·563	0·553	0·544	0·529	0·518	0·509	0·501	0·495	0·485	0·479
CsI	f							0·754	0·692	0·651	0·621	0·599	0·581	0·567	0·554	0·543	0·533	0·516	0·501	0·489	0·479	0·470	0·450	0·434
$CsNO_3$	b			0·92	0·89	0·85	0·78	0·733	0·655	0·602	0·561	0·528	0·501	0·478	0·458	0·439	0·422	0·393	0·368					
$CsOH$	a				0·925	0·879	0·831	0·795	0·761	0·744	0·739	0·739	0·742	0·748	0·754	0·762	0·771	$(m=1·3205, \gamma=0·818)$						
Cs_2SO_4	f							0·456	0·382	0·338	0·311	0·291	0·274	0·262	0·251	0·242	0·235	0·222	0·214	0·207	0·201			
$CuCl_2$	b	0·888	0·849	0·783	0·723	0·659	0·577	0·508	0·455	0·429	0·417	0·411	0·409	0·409	0·410	0·413	0·417	0·425	0·434	0·444	0·455	0·466	0·494	0·520
$Cu(NO_3)_2$	f							0·511	0·460	0·439	0·429	0·426	0·427	0·431	0·437	0·445	0·455	0·478	0·503	0·533	0·569	0·609	0·727	0·903
$CuSO_4$	g	0·74		0·573	0·438	0·317	0·217	0·154	0·104	0·083	0·071	0·062	0·056	0·052	0·048	0·045	0·043	0·039	0·037					
$ErBr_3$	a	0·789	0·727	0·634	0·557	0·482	0·393																	
$ErCl_3$	a	0·788	0·725	0·631	0·551	0·476	0·385																	

[a] E.M.F. method. [b] Freezing point method at $m < 0·1$ then isopiestic. [c] Isopiestic method based on arbitrary value at $m = 0·1$. [d] Freezing point method. [e] Direct measurement of vapour pressure. [f] Isopiestic method. [g] E.M.F. method at $m < 0·1$ then isopiestic. [h] Solubility. [i] Freezing point method at $m < 0·1$ then E.M.F. [j] Equilibrium method.

Table 19 (*cont.*)

Molality		0·001	0·002	0·005	0·01	0·02	0·05	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9	1·0	1·2	1·4	1·6	1·8	2·0	2·5	3·0
Salt																								
$\mathrm{EuCl_3}$	g	0·787	0·725	0·630	0·550	0·473	0·383	0·318	0·282	0·270	0·270	0·276	0·286	0·303	0·322	0·345	0·371	0·436	0·525	0·641	0·792	0·995		
$\mathrm{FeCl_2}$	f							0·518	0·473	0·454	0·448	0·450	0·454	0·463	0·473	0·488	0·506	0·547	0·596	0·653	0·719	0·794		
$\mathrm{GdBr_3}$	a	0·788	0·726	0·632	0·553	0·478	0·387																	
$\mathrm{GdCl_3}$	a	0·787	0·725	0·631	0·551	0·474	0·384																	
HBr	a	0·966		0·930	0·906	0·879	0·838	0·805	0·782	0·777	0·781	0·789	0·801	0·815	0·832	0·850	0·871					1·183		1·693
HCl	a	0·965	0·952	0·928	0·904	0·875	0·830	0·796	0·767	0·756	0·755	0·757	0·763	0·772	0·783	0·795	0·809	0·840	0·876	0·916	0·960	1·009	1·147	1·316
$\mathrm{HClO_4}$	f							0·803	0·778	0·768	0·766	0·769	0·776	0·785	0·795	0·808	0·823	0·858	0·900	0·947	0·998	1·055	1·227	1·448
HF	a	0·544		0·300	0·224		0·106	0·077		0·044		0·031					0·024							
HI	f							0·818	0·807	0·811	0·823	0·839	0·860	0·883	0·908	0·935	0·963	1·027	1·098	1·175	1·260	1·356	1·641	2·015
$\mathrm{HNO_3}$	d	0·965	0·951	0·927	0·902	0·871	0·823	0·791	0·754	0·735	0·725	0·720	0·717	0·717	0·718	0·721	0·724	0·734	0·745	0·758	0·775	0·793	0·846	0·909
$\mathrm{H_2SO_4}$	ae	0·830	0·757	0·639	0·544	0·453	0·340	0·265	0·209	0·183	0·167	0·156	0·148	0·142	0·138	0·134	0·132	0·128	0·127	0·126	0·126	0·128	0·133	0·142
$\mathrm{H_2SeO_4}$	a			0·574	0·492	0·408	0·312	0·255																
$\mathrm{HoBr_3}$	a	0·792	0·731	0·642	0·566	0·496	0·409																	
$\mathrm{In_2(SO_4)_3}$	a				0·142	0·095	0·054	0·035	0·022	0·017	0·015													
KBr	b	0·965	0·952	0·927	0·903	0·872	0·822	0·772	0·722	0·693	0·673	0·657	0·646	0·636	0·629	0·622	0·617	0·608	0·602	0·598	0·595	0·593	0·593	0·595
$\mathrm{KBrO_3}$	f							0·745	0·674	0·625	0·585	0·552												
KCNS	f							0·769	0·716	0·685	0·663	0·646	0·633	0·623	0·614	0·606	0·599	0·587	0·577	0·569	0·562	0·556	0·546	0·538
$\mathrm{K_2CO_3}$	d	0·892	0·858	0·807	0·745	0·678	0·576	0·497	0·430			0·357					0·327					0·331		0·39
KCl	g	0·965	0·952	0·927	0·902	0·869	0·816	0·770	0·718	0·688	0·666	0·649	0·637	0·626	0·618	0·610	0·604	0·593	0·586	0·580	0·576	0·573	0·569	0·569
$\mathrm{KClO_3}$	b	0·967	0·955	0·932	0·907	0·875	0·813	0·749	0·681	0·635	0·599	0·568	0·541	0·518										
$\mathrm{KClO_4}$	d	0·965	0·951	0·924	0·895	0·857	($m = 0·04834$, $\gamma = 0·7887$)																	
$\mathrm{K_2CrO_4}$	f							0·456	0·382	0·340	0·313	0·292	0·276	0·263	0·253	0·243	0·235	0·223	0·214	0·207	0·201	0·196	0·190	0·190
KF	f							0·775	0·727	0·700	0·682	0·670	0·661	0·654	0·650	0·646	0·645	0·643	0·644	0·647	0·652	0·658	0·678	0·705
$\mathrm{K_3Fe(CN)_6}$	c							0·268	0·212	0·184	0·167	0·155	0·146	0·140	0·135	0·131	0·128	0·124	0·122					
$\mathrm{K_4Fe(CN)_6}$	c							0·139	0·100	0·081	0·070	0·062	0·056	0·052	0·048	0·046								
$\mathrm{KH_2PO_4}$	f							0·731	0·653	0·602	0·561	0·529	0·501	0·477	0·456	0·438	0·421	0·393	0·369	0·348	0·332			
KI	g	0·952		0·928	0·903	0·872	0·820	0·778	0·733	0·707	0·689	0·676	0·667	0·660	0·654	0·649	0·645	0·640	0·637	0·636	0·636	0·637	0·644	0·652
$\mathrm{KNO_3}$	b	0·965	0·951	0·926	0·898	0·862	0·799	0·739	0·663	0·614	0·576	0·545	0·519	0·496	0·476	0·459	0·443	0·414	0·390	0·369	0·350	0·333	0·297	0·269
KOH	a						0·824	0·798	0·760	0·742	0·734	0·732	0·733	0·736	0·742	0·749	0·756	0·776	0·800	0·827	0·856	0·888	0·974	1·081
$\mathrm{K_2SO_4}$	b	0·885		0·777	0·711	0·638	0·525	0·441	0·360	0·316	0·286	0·264	0·246	0·232										
$\mathrm{LaBr_3}$	a	0·790	0·729	0·639	0·562	0·490	0·402																	
$\mathrm{LaCl_3}$	g	0·790	0·729	0·636	0·560	0·483	0·388	0·314	0·274	0·263	0·261	0·266	0·274	0·285	0·302	0·321	0·342	0·398	0·470	0·561	0·677	0·825		
LiBr	b	0·966	0·954	0·932	0·909	0·882	0·842	0·796	0·766	0·756	0·752	0·753	0·758	0·767	0·777	0·789	0·803	0·837	0·874	0·917	0·964	1·015	1·161	1·341
LiCl	b	0·963	0·948	0·921	0·895	0·865	0·819	0·790	0·757	0·744	0·740	0·739	0·743	0·748	0·755	0·764	0·774	0·796	0·823	0·853	0·885	0·921	1·026	1·156
$\mathrm{LiClO_4}$	f							0·812	0·794	0·792	0·798	0·808	0·820	0·834	0·852	0·869	0·887	0·931	0·979	1·034	1·093	1·158	1·350	1·582
LiI	f							0·815	0·802	0·804	0·813	0·824	0·838	0·852	0·870	0·888	0·910	0·955	1·007	1·063	1·127	1·198	1·418	1·715
$\mathrm{LiNO_3}$	b	0·966	0·953	0·930	0·904	0·878	0·834	0·788	0·752	0·736	0·728	0·726	0·727	0·729	0·733	0·737	0·743	0·757	0·774	0·792	0·812	0·835	0·896	0·966
LiOH	a						0·803	0·760	0·702	0·665	0·638	0·617	0·599	0·585	0·573	0·563	0·554	0·542	0·532	0·525	0·518	0·513	0·503	0·494
$\mathrm{Li_2SO_4}$	f							0·468	0·398	0·361	0·337	0·319	0·307	0·297	0·289	0·282	0·277	0·271	0·267	0·265	0·264	0·263	0·274	0·288
$\mathrm{MgBr_2}$	f							0·550	0·519	0·518	0·527	0·545	0·571	0·599	0·635	0·677	0·723	0·837	0·975	1·143	1·351	1·614	2·59	4·26
$\mathrm{MgCl_2}$	f							0·529	0·489	0·477	0·475	0·481	0·491	0·506	0·522	0·544	0·570	0·631	0·709	0·804	0·916	1·053	1·541	2·32
$\mathrm{Mg(ClO_4)_2}$	f							0·590	0·578	0·589	0·613	0·647	0·688	0·739	0·798	0·868	0·946	1·137	1·385	1·705	2·13	2·65	4·89	9·19
$\mathrm{MgI_2}$	f							0·580	0·558	0·567	0·584	0·614	0·653	0·698	0·753	0·817	0·892	1·069	1·291	1·580	1·957	2·43	4·33	7·93
$\mathrm{Mg(NO_3)_2}$	b	0·882	0·838	0·771	0·712	0·642	0·554	0·523	0·481	0·468	0·466	0·470	0·479	0·489	0·502	0·519	0·537	0·581	0·632	0·692	0·761	0·837	1·090	1·452
$\mathrm{MgSO_4}$	c							0·150	0·108	0·088	0·076	0·068	0·062	0·057	0·054	0·051	0·049	0·045	0·044	0·042	0·042	0·042	0·044	0·049
$\mathrm{MnCl_2}$	f							0·516	0·469	0·450	0·442	0·440	0·443	0·448	0·455	0·466	0·479	0·507	0·542	0·581	0·624	0·668	0·793	0·934
$\mathrm{MnSO_4}$	c							0·150	0·106	0·085	0·073	0·064	0·058	0·053	0·049	0·046	0·044	0·040	0·038	0·037	0·036	0·035	0·035	0·038
$\mathrm{NH_4Cl}$	b			0·924	0·896	0·862	0·808	0·770	0·718	0·687	0·665	0·649	0·636	0·625	0·617	0·609	0·603	0·592	0·584	0·578	0·574	0·570	0·564	0·561
$\mathrm{NH_4NO_3}$	b			0·925	0·897	0·860	0·799	0·740	0·677	0·636	0·606	0·582	0·562	0·545	0·530	0·516	0·504	0·483	0·464	0·447	0·433	0·419	0·391	0·368
NaBr	b	0·97	0·96	0·94	0·91	0·89	0·85	0·782	0·741	0·719	0·704	0·697	0·692	0·689	0·687	0·687	0·687	0·692	0·699	0·706	0·718	0·731	0·768	0·812

a–j For method used, see footnotes on page 20.

Table 19 (*cont.*)

Molality		0·001	0·002	0·005	0·01	0·02	0·05	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9	1·0	1·2	1·4	1·6	1·8	2·0	2·5	3·0
Salt																								
$NaBrO_3$	b	0·967	0·956	0·934	0·911	0·880	0·826	0·758	0·696	0·657	0·628	0·605	0·585	0·569	0·554	0·541	0·528	0·507	0·489	0·473	0·461	0·450	0·426	
NaCNS	f							0·787	0·750	0·731	0·720	0·715	0·712	0·710	0·710	0·711	0·712	0·716	0·723	0·730	0·737	0·744	0·779	0·814
NaCl	b	0·965	0·952	0·928	0·903	0·872	0·822	0·778	0·735	0·710	0·693	0·681	0·673	0·667	0·662	0·659	0·657	0·654	0·655	0·657	0·662	0·668	0·688	0·714
$NaClO_3$	b	0·965	0·953	0·928	0·904	0·873	0·822	0·775	0·720	0·688	0·664	0·645	0·630	0·617	0·606	0·597	0·589	0·575	0·563	0·553	0·545	0·538	0·525	0·515
$NaClO_4$	f							0·775	0·729	0·701	0·683	0·668	0·656	0·648	0·641	0·635	0·629	0·622	0·616	0·613	0·611	0·609	0·609	0·611
Na_2CrO_4	f							0·464	0·394	0·353	0·327	0·307	0·292	0·280	0·269	0·261	0·253	0·241	0·233	0·227	0·224	0·222	0·225	0·236
NaF	f							0·765	0·710	0·676	0·651	0·632	0·616	0·603	0·592	0·582	0·573							
NaH_2PO_4	f							0·744	0·675	0·629	0·593	0·563	0·539	0·517	0·499	0·483	0·468	0·442	0·420	0·401	0·385	0·371	0·343	0·320
NaI	f							0·787	0·751	0·735	0·727	0·723	0·723	0·724	0·727	0·731	0·736	0·747	0·763	0·780	0·799	0·820	0·883	0·963
$NaIO_3$	d			0·924	0·895	0·856	0·784	0·714																
$NaNO_3$	b	0·966	0·953	0·929	0·905	0·873	0·821	0·762	0·703	0·666	0·638	0·617	0·599	0·583	0·570	0·558	0·548	0·530	0·514	0·501	0·489	0·478	0·455	0·437
NaOH	i				0·905	0·871	0·818	0·766	0·727	0·708	0·697	0·690	0·685	0·681	0·679	0·678	0·678	0·681	0·686	0·692	0·700	0·709	0·743	0·784
Na_2SO_4	b	0·887	0·847	0·778	0·714	0·642	0·536	0·445	0·365	0·320	0·289	0·266	0·248	0·233	0·221	0·210	0·201	0·186	0·175	0·165	0·158	0·152	0·142	0·137
$Na_2S_2O_3$	f							0·457	0·382	0·340	0·313	0·292	0·276	0·262	0·251	0·242	0·234	0·222	0·214	0·207	0·202	0·198	0·195	0·199
$NdBr_3$	a	0·790	0·728	0·637	0·560	0·487	0·398																	
$NdCl_3$	g	0·789	0·727	0·634	0·557	0·481	0·393	0·310	0·272	0·261	0·259	0·264	0·272	0·284	0·301	0·321	0·344	0·403	0·480	0·577	0·704	0·867		
$NiCl_2$	f							0·522	0·479	0·463	0·460	0·464	0·471	0·482	0·496	0·515	0·536	0·586	0·647	0·720	0·805	0·906	1·236	1·692
$NiSO_4$	c							0·150	0·105	0·084	0·071	0·063	0·056	0·052	0·047	0·044	0·042	0·039	0·036	0·035	0·034	0·034	0·035	
$PbBr_2$	a		0·794	0·687	0·581																			
$PbCl_2$	a	0·859	0·803	0·704	0·612	0·497																		
$PrBr_3$	a	0·790	0·729	0·637	0·560	0·488	0·399																	
$PrCl_3$	g	0·788	0·726	0·632	0·553	0·477	0·387	0·311	0·273	0·260	0·258	0·262	0·268	0·281	0·297	0·316	0·338	0·395	0·467	0·558	0·675	0·825		
RbBr	f							0·763	0·706	0·673	0·650	0·632	0·617	0·605	0·595	0·586	0·578	0·565	0·556	0·547	0·541	0·536	0·526	0·520
RbCl	b			0·927	0·903	0·870	0·816	0·764	0·709	0·675	0·652	0·634	0·620	0·608	0·599	0·590	0·583	0·572	0·563	0·556	0·551	0·546	0·539	0·536
RbI	f							0·762	0·705	0·671	0·647	0·629	0·614	0·602	0·591	0·583	0·575	0·562	0·551	0·544	0·537	0·533	0·524	0·518
$RbNO_3$	f							0·734	0·658	0·606	0·565	0·534	0·508	0·485	0·465	0·446	0·430	0·402	0·377	0·356	0·338	0·321	0·285	0·257
Rb_2SO_4	f							0·451	0·374	0·331	0·301	0·279	0·263	0·249	0·238	0·228	0·219	0·206	0·196	0·189	0·182			
$ScCl_3$	c							0·320	0·288	0·282	0·287	0·298	0·316	0·339	0·369	0·405	0·443	0·544	0·677	0·853	1·089			
$SmCl_3$	g	0·787	0·725	0·631	0·551	0·474	0·384	0·314	0·278	0·267	0·266	0·271	0·280	0·296	0·314	0·336	0·362	0·424	0·509	0·616	0·756	0·940		
$SnCl_2$	j	0·809	0·716	0·624	0·512	0·398	0·283	0·233																
$SrBr_2$	f							0·526	0·483	0·468	0·465	0·467	0·473	0·484	0·497	0·515	0·535	0·583	0·643	0·715	0·800	0·906		
$SrCl_2$	b	0·90	0·87	0·81	0·76	0·70	0·62	0·511	0·462	0·442	0·433	0·430	0·431	0·434	0·441	0·449	0·461	0·489	0·524	0·565	0·614	0·670	0·855	1·126
SrI_2	f							0·553	0·520	0·517	0·524	0·536	0·555	0·578	0·608	0·642	0·680	0·773	0·885	1·021	1·191	1·407		
$Sr(NO_3)_2$	f							0·478	0·410	0·373	0·348	0·329	0·314	0·302	0·292	0·283	0·275	0·262	0·253	0·244	0·238	0·232	0·223	0·217
TlCl	a	0·962	0·946		0·876																			
$TlClO_4$	f							0·730	0·652	0·599	0·559	0·527												
$TlNO_3$	f							0·702	0·606	0·545	0·500													
$Th(NO_3)_4$	c							0·279	0·225	0·203	0·192	0·189	0·188	0·191	0·195	0·201	0·207	0·224	0·246	0·269	0·296	0·326	0·405	0·486
UO_2Cl_2	f							0·544	0·510	0·520	0·505	0·517	0·532	0·549	0·571	0·595	0·620	0·678	0·744	0·816	0·894	0·978	1·228	1·551
$UO_2(ClO_4)_2$	f							0·626	0·634	0·669	0·723	0·790	0·871	0·969	1·087	1·226	1·390	1·804	2·38	3·17	4·29	5·91	13·37	30·9
$UO_2(NO_3)_2$	f							0·551	0·520	0·518	0·526	0·542	0·563	0·587	0·617	0·651	0·689	0·773	0·868	0·975	1·099	1·237	1·626	2·03
UO_2SO_4	c							0·150	0·102	·0807	·0689	·0611	·0566	·0515	·0483	·0458	·0439	·0409	·0391	·0379	·0372	·0367	·0370	·0383
YCl_3	g	0·788	0·725	0·631	0·551	0·476	0·385	0·314	0·278	0·269	0·271	0·278	0·291	0·307	0·329	0·355	0·385	0·462	0·566	0·701	0·884	1·136		
$ZnBr_2$	g					0·685	0·605	0·547	0·510	0·502	0·504	0·511	0·519	0·528	0·537	0·547	0·552	0·561	0·567	0·569	0·570	0·572	0·581	0·598
$ZnCl_2$	g	0·88	0·84	0·77	0·71	0·64	0·56	0·515	0·462	0·432	0·411	0·394	0·380	0·369	0·357	0·348	0·339	0·323	0·309	0·300	0·294	0·289	0·285	0·287
$Zn(ClO_4)_2$	f							0·581	0·564	0·573	0·596	0·629	0·670	0·720	0·780	0·850	0·929	1·127	1·386	1·719	2·16	2·74	5·15	9·99
ZnI_2	g		0·851	0·799	0·746	0·690	0·621	0·581	0·559	0·564	0·582	0·610	0·645	0·683	0·724	0·762	0·800	0·870	0·928	0·972	1·007	1·028	1·070	1·123
$Zn(NO_3)_2$	f							0·531	0·489	0·474	0·469	0·473	0·480	0·489	0·501	0·518	0·535	0·574	0·625	0·680	0·774	0·817	1·049	1·363
$ZnSO_4$	g	0·700	0·608	0·477	0·387	0·298	0·202	0·150	0·104	0·083	0·071	0·063	0·057	0·052	0·048	0·046	0·043	0·040	0·038	0·036	0·035	0·035	0·037	0·041

a–j For methods used, see footnote on page 20.

20 STOICHIOMETRIC MEAN MOLAL ACTIVITY COEFFICIENTS FOR AQUEOUS SOLUTIONS OF SALTS OF ORGANIC ACIDS AT 25° C

Molality	0·1	0·2	0·3	0·4	0·5	0·6	0·7	0·8	0·9	1·0	1·2	1·4	1·5	1·6	1·8	2·0	2·5	3·0	3·5	4·0	4·5	5·0
Salt																						
$CsOOCCH_3$	0·799	0·771	0·761	0·759	0·762	0·768	0·776	0·783	0·792	0·802	0·826	0·853		0·883	0·916	0·950	1·041	1·145	1·263			
$KOOCH_3$	0·796	0·766	0·754	0·750	0·751	0·754	0·759	0·766	0·774	0·783	0·803	0·827		0·854	0·881	0·910	0·995	1·086	1·181			
KTol [a]	0·762	0·702	0·662	0·632	0·605	0·582	0·560	0·541	0·523	0·506	0·476	0·448		0·424	0·404	0·386	0·347	0·317	0·292			
$KOOCCH_2COOH$	0·759	0·702	0·665	0·634	0·610	0·588	0·570	0·544	0·541	0·528	0·507	0·488	0·480	0·472	0·460	0·450	0·427	0·408	0·392	0·377	0·365	0·353
$KOOC(CH_2)_2COOH$	0·762	0·705	0·668	0·640	0·619	0·602	0·588	0·575	0·564	0·553	0·536	0·521	0·516	0·510	0·501	0·493	0·478	0·468	0·463	0·457	0·453	
$KOOC(CH_2)_4COOH$	0·772	0·724	0·693	0·669	0·654	0·642	0·631	0·622	0·615	0·609												
$LiOOCCH_3$	0·784	0·742	0·721	0·709	0·700	0·691	0·689	0·688	0·688	0·689	0·693	0·700		0·709	0·719	0·729	0·762	0·798	0·837	0·877		
LiTol [a]	0·772	0·723	0·695	0·674	0·659	0·647	0·638	0·630	0·623	0·617	0·605	0·595		0·586	0·575	0·568	0·558	0·556	0·559	0·566	0·575	
$NaOOCH$	0·778	0·734	0·710	0·696	0·685	0·676	0·671	0·667	0·664	0·661	0·658	0·657	0·656	0·656	0·657	0·658	0·667	0·678	0·691			
$NaOOCCH_3$	0·791	0·757	0·744	0·737	0·735	0·736	0·740	0·745	0·752	0·757	0·769	0·789		0·809	0·829	0·851	0·914	0·982	1·057			
$NaOOCCH_2CH_3$	0·800	0·772	0·763	0·762	0·764	0·769	0·777	0·787	0·797	0·808	0·833	0·864	0·880	0·897	0·932	0·966	1·061	1·160				
$NaOOC(CH_2)_2CH_3$	0·800	0·774	0·769	0·774	0·782	0·795	0·812	0·830	0·848	0·868	0·908	0·952	0·973	0·992	1·036	1·083	1·182	1·278	1·368			
$NaOOC(CH_2)_3CH_3$	0·800	0·776	0·771	0·780	0·790	0·805	0·817	0·835	0·852	0·868	0·907	0·945	0·963	0·984	1·012	1·030	1·027	0·982	0·901			
$NaOOC(CH_2)_4CH_3$	0·803	0·779	0·775	0·783	0·794	0·810	0·826	0·841	0·851	0·858	0·865	0·855	0·845	0·830	0·799	0·763	0·673	0·612	0·576	0·556	0·542	
$NaOOC(CH_2)_5CH_3$	0·803	0·780	0·777	0·780	0·783	0·781	0·775	0·754	0·700	0·650	0·562	0·512	0·491	0·468	0·430	0·398	0·340	0·306	0·284	0·267	0·255	0·245
$NaOOC(CH_2)_6CH_3$					0·693	0·621	0·553	0·491	0·434	0·401	0·349	0·309		0·279	0·253	0·236	0·206	0·185				
$NaOOC(CH_2)_7CH_3$					0·390	0·335	0·295	0·264	0·239	0·219	0·189	0·168		0·152	0·140	0·130	0·126					
$NaOOC(CH_2)_8CH_3$					0·285	0·244	0·212	0·184	0·169	0·147	0·120	0·107		0·097	0·089							
NaTol [a]	0·765	0·709	0·674	0·648	0·627	0·609	0·593	0·579	0·566	0·554	0·532	0·511		0·493	0·476	0·460	0·427	0·402	0·383	0·368		
$NaOOCCH_2$(cis)	0·430	0·354	0·314	0·289	0·272	0·262	0·250	0·243	0·236	0·231	0·224	0·219		0·216	0·214	0·213	0·215	0·220				
$NaOOCCH_2$(trans)	0·465	0·402	0·369	0·348	0·335	0·328	0·323	0·320	0·319	0·319	0·320	0·323		0·330	0·336	0·343						
$NaOOCCH_2COOH$	0·764	0·709	0·674	0·647	0·626	0·609	0·595	0·582	0·572	0·563	0·546	0·533	0·528	0·523	0·514	0·507	0·490	0·477	0·467	0·458	0·451	0·445
$NaOOC(CH_2)_2COOH$	0·765	0·712	0·677	0·653	0·635	0·618	0·607	0·596	0·586	0·579	0·565	0·556	0·552	0·548	0·543	0·538	0·529	0·526	0·524	0·525	0·528	0·534
$NaOOC(CH)_{24}COOH$	0·776	0·730	0·703	0·683	0·670	0·658	0·650															
$RbOOCCH_3$	0·796	0·767	0·756	0·753	0·755	0·759	0·766	0·773	0·782	0·792	0·815	0·840		0·869	0·900	0·933	1·023	1·126	1·240			
$TlOOCCH_3$	0·750	0·686	0·644	0·614	0·589	0·570	0·553	0·539	0·526	0·515	0·496	0·480		0·466	0·454	0·444	0·422	0·405	0·389	0·376	0·364	0·354

[a] Tol = Toluene sulphonate.

21 STOICHIOMETRIC MEAN MOLAL ACTIVITY COEFFICIENTS FOR CONCENTRATED AQUEOUS INORGANIC ELECTROLYTES AT 25°C

Molality	3·5	4·0	4·5	5·0	6·0	7·0	8·0	9·0	10·0
Salt									
$AgNO_3$	0·229	0·210	0·194	0·181	0·159	0·142	0·129	0·118	0·109
$CaBr_2$	3·89	6·28	10·66	18·47	55·8	163	375	696	
$CaCl_2$	2·08	2·93	4·17	5·89	11·11	18·28	26·0	34·2	43·0
$Ca(NO_3)_2$	0·405	0·435	0·469	0·507	0·592	0·690	0·801		
$CdBr_2$	·0290	·0278							
$CdCl_2$	·0325	·0306	·0291	·0279	·0263				
$CdSO_4$	0·036								
$CoBr_2$	5·10	7·62	11·02	15·36	(at $m=5·5$, $\gamma=20·6$)				
$CoCl_2$	1·832	2·22							
CoI_2	13·6	24	40	62	102	130	150	174	214
$Co(NO_3)_2$	1·526	1·972	2·55	3·31	(at $m=5·5$, $\gamma=4·23$)				
$CsBr$	0·460	0·457	0·455	0·453					
$CsCl$	0·475	0·474	0·474	0·475	0·480				
$CuCl_2$	0·547	0·573	0·597	0·621	0·673				
$Cu(NO_3)_2$	1·118	1·381	1·690	2·05	2·98	4·21	5·79		
HCl	1·518	1·762	2·04	2·38	3·22	4·37	5·90	7·94	10·44
$HClO_4$	1·726	2·08	2·53	3·11	4·76	7·44	11·83	19·11	30·9
H_2SO_4	0·155	0·170	0·188	0·208	0·257	0·317	0·386	0·467	0·559
KBr	0·600	0·608	0·616	0·626					
$KCNS$	0·533	0·529	0·526	0·524					
KCl	0·572	0·577	0·583						
KI	0·662	0·673	0·683						
KOH	1·215	1·352	1·53	1·72	2·20	2·88	3·77	4·86	6·22
$LiBr$	1·584	1·897	2·28	2·74	3·92	5·76	8·61	12·92	19·92
$LiCl$	1·317	1·510	1·741	2·02	2·72	3·71	5·10	6·96	9·40
$LiClO_4$	1·866	2·18							
$LiNO_3$	1·044	1·125	1·215	1·310	1·506	1·732	1·952	2·19	2·44
$LiOH$	0·487	0·481							
$MgBr_2$	7·15	12·2	21·1	36·6	(at $m=5·63$, $\gamma=71·2$)				
$MgCl_2$	3·56	5·54	8·74	13·95	(at $m=5·84$, $\gamma=31·6$)				
$Mg(ClO_4)_2$	17·65	34·1			(at $m=4·4$, $\gamma=56·6$)				
MgI_2	15·0	29·0	57·6	115					
$MnCl_2$	1·084	1·235	1·395	1·55	1·88	2·25	2·68		
$MnSO_4$	0·042	0·048							
NH_4Cl	0·560	0·560	0·561	0·562	0·564	0·566	($m=7·390$, $\gamma=5·66$)		
NH_4NO_3	0·348	0·331	0·316	0·302	0·279	0·261	0·245	0·232	0·221
$NaBr$	0·865	0·929							
$NaCNS$	0·854	0·897							
$NaCl$	0·746	0·783	0·826	0·874	0·986				
$NaClO_4$	0·617	0·626	0·637	0·649	0·677				
NaH_2PO_4	0·305	0·293	0·283	0·276	0·265				
$NaNO_3$	0·422	0·408	0·396	0·386	0·371				
$NaOH$	0·835	0·903	0·985	1·077	1·299	1·603	2·01	2·55	3·23
Na_2SO_4	0·135	0·135							
$NiCl_2$	2·26	2·96	3·76	4·69	(at $m=5·8$, $\gamma=6·43$)				
$RbBr$	0·516	0·514	0·514	0·515					
$RbCl$	0·536	0·538	0·541	0·546					
RbI	0·516	0·515	0·516	0·517					
$RbNO_3$	0·234	0·216	0·200						

Table 21 (*cont.*)

Molality	3·5	4·0	4·5	5·0	6·0	7·0	8·0	9·0	10·0
Salt									
$SrCl_2$	1·492	1·977							
$Sr(NO_3)_2$	0·214	0·212							
$Th(NO_3)_4$	0·568	0·647	0·722	0·791					
$UO_2(ClO_4)_2$	70·4	160·2	358	750					
$UO_2(NO_3)_2$	2·41	2·68	2·89	3·06					
UO_2SO_4	·0401	·0433	·0465	·0500	·0571				
$ZnBr_2$	0·626	0·664	0·714	0·774	0·930	1·149	1·439	1·809	2·26
$ZnCl_2$	0·295	0·307	0·328	0·354	0·417	0·499	0·607	0·737	0·898
ZnI_2	1·188	1·259	1·357	1·476	1·774	2·20	2·80	3·57	4·47
$Zn(NO_3)_2$	1·773	2·31	2·99	3·88	6·41				

Molality	11	12	13	14	15	16
Salt						
$AgNO_3$	0·102	0·096	0·090			
HCl	13·51	17·25	21·8	27·3	34·1	42·4
$HClO_4$	50·1	80·8	129·5	205·0	322·0	500·0
H_2SO_4	0·643	0·742	0·830	0·967	1·093	1·234
KOH	8·10	10·5	13·2	15·8	19·6	24·6
$LiBr$	31·0	46·3	70·6	104·7	146·0	198·0
$LiCl$	12·55	16·41	20·9	26·2	31·9	37·9
$LiNO_3$	2·69	2·95	3·20			
NH_4NO_3	0·210	0·202	0·194	0·186	0·180	0·174
$NaOH$	4·10	5·19	6·50	8·04	9·74	11·58
$ZnBr_2$		3·39		4·63		5·90
$ZnCl_2$		1·294		1·73		2·18
ZnI_2		6·52				

Molality	17	18	19	20	22	25
Salt						
H_2SO_4	1·387					
$LiBr$	260·0	331·0	411·0	485·0		
$LiCl$	43·8	49·9	56·3	62·4		
NH_4NO_3	0·168	0·163	0·158	0·153	0·145	0·135
$NaOH$	13·47	15·41	17·38	19·33	23·1	28·0
$ZnBr_2$		6·92		7·86		
$ZnCl_2$		2·63		3·06	3·46	

22 THE IONIC ACTIVITY FUNCTION OF WATER $\gamma_H\gamma_{OH}/a_{H_2O}$ IN SALT SOLUTIONS

Constants for the equation

$$\log_{10}(\gamma_H\gamma_{OH}/a_{H_2O}) = -2\mathfrak{S}_{(f)}\sqrt{I}/(1+A'\sqrt{I})+(b_0+b_1t)I+(c_0+c_1t)I^{3/2}.$$

For values of $\mathfrak{S}_{(f)}$ and A' see Table 13. Valid up to 3m and from 0° to 50°C for NaCl and KCl, 0° to 40°C for KBr, LiBr and NaBr and from 10°C to 40°C for LiCl. I = ionic strength, t = temperature in °C, γ = Stoichiometric molal activity coefficient

Salt	$\mathring{a}$	b_0	$b_1 \times 10^4$	c_0	$c_1 \times 10^4$
KBr	4·2	0·205	12·75	−0·016	−9·0
KCl	3·6	0·266	5·20	−0·0350	−4·88
LiBr	4·2	0·000	0·00	+0·0475	−2·20
LiCl	3·6	0·039	2·00	+0·0325	−4·0
NaBr	4·2	0·157	6·75	+0·010	−6·57
NaCl	3·6	0·198	2·00	−0·0085	−2·0

23 VALUES OF THE CONSTANTS n AND $\mathring{a}$

in the equation (valid to $m_{max.}$).

$$\log_{10}\gamma_\pm\,(25°\mathrm{C}) = -\mathfrak{S}_{(f)}\sqrt{c}/(1+A'\sqrt{c})-(n/\nu)\log_{10}a_w-\log_{10}[1-0{\cdot}018\,(n-\nu)m].$$

For values of $\mathfrak{S}_{(f)}$ and A' see Table 13.

Salt	$\mathring{a}$	n	$m_{max.}$	Salt	$\mathring{a}$	n	$m_{max.}$
$BaBr_2$	4·68	10·7	1·5	$LiClO_4$	5·63	8·7	1·0
$BaCl_2$	4·45	7·7	1·8	LiI	5·60	9·0	1·0
BaI_2	5·44	15·0	1·0	$MgBr_2$	5·46	17·0	1·0
$CaBr_2$	5·02	14·6	1·0	$MgCl_2$	5·02	13·7	1·4
$CaCl_2$	4·73	12·0	1·4	MgI_2	6·18	19·0	0·7
CaI_2	5·69	17·0	0·7	$MnCl_2$	4·74	11·0	1·4
$CoBr_2$	5·35	16·	1·1	NH_4Cl	3·75	1·6	6·0
$CoCl_2$	4·81	13·0	1·0	NaBr	4·24	4·2	4·0
CoI_2	5·93	20·	0·9	NaCl	3·97	3·5	5·0
$FeCl_2$	4·80	12·0	1·4	$NaClO_4$	4·04	2·1	4·0
HBr	5·18	8·6	1·0	NaI	4·47	5·5	1·5
HCl	4·47	8·0	1·0	$NiCl_2$	4·86	13·0	1·4
$HClO_4$	5·09	7·4	2·0	RbBr	3·48	0·9	1·5
HI	5·69	10·6	0·7	RbCl	3·49	1·2	1·5
KBr	3·85	2·1	4·0	RbI	3·56	0·6	1·5
KCl	3·63	1·9	4·0	$SrBr_2$	4·89	12·7	1·4
KI	4·16	2·5	4·0	$SrCl_2$	4·61	10·7	1·8
LiBr	4·56	7·6	1·5	SrI_2	5·58	15·5	1·0
LiCl	4·32	7·1	1·0	$Zn(ClO_4)_2$	6·18	20.0	0·7

$\gamma_\pm$ = Stoichiometric mean molal activity coefficient
m = molality (moles solute per 1000 g solvent)
c = molar concentration (moles solute per litre solution)
ν = number of ions produced by dissociation of one molecule of salt
a_w = activity of water in the solution. n = number of water molecules bound to the ν ions

24 VALUES OF THE CONSTANTS $\mathring{a}$, B AND D:

In the equation $\log_{10}\gamma_\pm(25°\mathrm{C}) = -\mathfrak{S}_{(f)}\sqrt{c}/(1+A'\sqrt{c})+Bc+Dc^2$. Valid up to 4$m$.
For values of $\mathfrak{S}_{(f)}$ and A' see Table 13

Salt	$\mathring{a}$	B	D	Salt	$\mathring{a}$	B	D
CsBr	2·5	0·0162	0·0033	KCl	3·85	0·0187	0·0034
CsCl	2·5	0·0229	0·0024	KI	3·95	0·0440	0·0016
CsI	2·5	0·0140	0·0	KOH	3·7	0·1294	—[a]
HBr	4·4	0·165	—[a]	NaBr	4·2	0·0590	0·0064
HCl	4·3	0·1292	0·00615	NaCl	4·2	0·0410	0·0053
HI	5·5	0·1725	0·0128	NaI	4·2	0·090	0·0058
LiBr	4·3	0·126	0·0099	NaOH	3·24	0·0460	—[a]
LiCl	4·25	0·111	0·0070	RbBr	3·2	0·0193	0·0021
LiI	5·0	0·155	0·0113	RbCl	3·2	0·0235	0·0023
KBr	3·85	0·0247	0·0035	RbI	3·2	0·0162	0·0031

[a] Valid up to 1m only.

$\gamma_\pm$ = Stoichiometric mean molal activity coefficient
c = molar concentration (moles solute per litre solution)

25 STOICHIOMETRIC MEAN MOLAL ACTIVITY COEFFICIENTS AT 25°C FOR SOLUTIONS OF HYDROCHLORIC ACID IN NON-AQUEOUS SOLVENTS AND AQUEOUS-NON-AQUEOUS MIXTURES

The composition of mixtures is expressed as weight per cent of non-aqueous component and the reference state is infinite dilution in the given solvent medium

Glucose									Acetic acid	
m	5%	10%	15%	20%	25%	30%	40%	50%	m	100%
0·001									0·0004	0·357
0·002									0·0016	0·184
0·005	0·929	0·942	0·923	0·944	0·918	0·941	0·912	0·906	0·0036	0·143
0·007									0·0064	0·111
0·01	0·904	0·907	0·889	0·903	0·887	0·897	0·877	0·869	0·01	0·091
0·02	0·877	0·873	0·855	0·867	0·849	0·856	0·841	0·830	0·0225	0·064
0·03			0·831		0·828		0·817	0·807	0·04	0·048
0·05	0·833	0·829	0·805	0·818	0·800	0·811	0·785	0·776	0·0625	0·040
0·07	0·816	0·811	0·785	0·801	0·779	0·793	0·764	0·755	0·09	0·034
0·1	0·799	0·794	0·766	0·782	0·760	0·774	0·743	0·733	0·1225	0·029
0·2	0·769	0·765		0·750		0·746			0·16	0·025
0·3	0·759	0·753		0·743		0·739				
0·5	0·762	0·753		0·744		0·743				
0·7		0·776		0·777						

m = molality (moles solute per 1000 g solvent)

Table 25 (cont.)

	Dioxan				Glycerol		Methanol							
m	20%	45%	70%	82%	3·06%	21·2%	10%	20%	43·3%	64%	84·2%	94·2%	*m*	100%
0·001			0·700	0·398			0·962	0·959	0·947	0·934	0·911	0·895	0·001	0·876
0·002			0·618	0·315	0·951		0·948	0·943	0·928	0·900	0·878	0·855	0·002	0·833
0·005	0·896	0·808	0·505	0·218	0·924	0·898	0·922	0·915	0·891	0·861	0·820	0·791	0·003	0·804
0·007	0·880	0·782	0·462	0·190									0·005	0·762
0·01	0·862	0·753	0·418	0·163	0·902	0·885	0·897	0·888	0·857	0·821	0·764	0·732	0·008	0·722
0·02	0·821	0·692	0·342	0·121	0·873	0·858	0·866	0·856	0·817	0·773	0·708	0·662	0·01	0·701
0·03	0·796	0·654	0·303	0·102									0·02	0·629
0·05	0·763	0·607	0·258	0·083	0·826	0·810	0·819	0·806	0·752	0·706	0·617		0·05	0·522
0·07	0·740	0·577	0·234	0·071									0·075	0·47
0·1	0·720	0·547	0·212	0·063	0·798	0·775	0·780	0·762	0·702	0·653	0·563		0·116	0·42
0·2	0·676	0·496	0·180	0·052	0·764	0·744	0·747	0·727		0·605			0·480	0·33
0·3	0·661	0·476	0·168	0·049									0·557	0·32
0·5	0·660	0·465	0·163	0·050	0·755	0·737	0·737	0·708	0·636	0·578	0·476			
0·7	0·672	0·471	0·168		0·772	0·760								
1·0	0·704	0·497	0·187		0·810	0·801	0·783	0·747	0·666	0·597	0·499			
1·5	0·786	0·570	0·240		0·901	0·901	0·861	0·814	0·732					
2·0	0·898	0·676			1·019	1·030	0·966	0·911	0·773					
2·5					1·161	1·190								
3·0	1·219	1·001			1·345	1·385								
4·0					1·792	1·914								

	Glycol				Ethanol								Isopropanol	
m	10%	20%	40%	60%	*m*	10%	*m*	20%	*m*	28·2%	*m*	100%	*m*	10%
0·001		0·959	0·957	0·946	0·00631	0·914	0·00470	0·915	0·005	0·815	0·005	0·728	0·001862	0·948
0·002		0·942	0·939	0·926	0·00758	0·907	0·00787	0·894	0·01	0·757	0·01	0·632	0·004019	0·927
0·005	0·897	0·911	0·908	0·892	0·01088	0·891	0·01015	0·883	0·02	0·676	0·02	0·544	0·006356	0·911
0·01	0·871	0·878	0·876	0·858	0·01987	0·864	0·01983	0·850	0·05	0·586	0·0249	0·514	0·008616	0·899
0·02	0·851	0·845	0·843	0·820	0·04210	0·824	0·04150	0·809	0·1	0·521	0·0423	0·445	0·00892	0·898
0·05	0·805	0·799	0·791	0·763	0·05100	0·814	0·05166	0·794	0·2	0·471	0·05	0·426	0·02089	0·858
0·1	0·770	0·764	0·750	0·717	0·07085	0·795	0·07123	0·775	0·5	0·432	0·1	0·352	0·03558	0·830
0·2	0·743	0·728	0·712	0·685	0·0800	0·788	0·0816	0·770	1·0	0·449	0·1242	0·327	0·04855	0·813
0·5	0·734	0·726	0·707	0·672	0·0885	0·783	0·0924	0·761	1·5	0·510	0·1782	0·300	0·06685	0·795
1·0	0·784	0·780	0·760		0·1091	0·773	0·1042	0·751	2·0	0·582	0·2	0·286	0·07947	0·785
					0·1990	0·744	0·3038	0·699	2·5	0·697	0·4437	0·218	0·1119	0·766
					0·2999	0·731	0·4751	0·698			1·0	0·177	0·1921	0·740
					0·5050	0·730	0·7309	0·709			1·050	0·168	0·2990	0·726
					0·7014	0·743	1·0216	0·741			1·481	0·159	0·4451	0·723
					0·9946	0·776	1·549	0·819			3·62	0·150	0·6993	0·737
					1·499	0·856	2·079	0·930					0·8863	0·757
					1·994	0·954							1·0	0·770

26 STOICHIOMETRIC MEAN MOLAL ACTIVITY COEFFICIENTS FOR H_2SO_4 IN NON-AQUEOUS SOLVENTS AND AQUEOUS-NON-AQUEOUS MIXTURES AT 25°C

The composition of mixtures is expressed as weight per cent of non-aqueous component

Methanol		Ethanol							Acetic acid		Iso-Propanol			
m	100%	*m*	10%	20%	35%	50%	65%	80%	*m*	100%	*m*	5%	10%	20%
0·0005	0·912	0·05	0·330	0·320	0·321	0·309	0·288	0·304	0·002461	0·171	0·05	0·322	0·323	0·322
0·001	0·879	0·1	0·254	0·245	0·245	0·235	0·216	0·226	0·006053	0·114	0·1	0·247	0·248	0·249
0·002	0·835	0·2	0·197	0·189	0·189	0·178	0·162	0·169	0·007730	0·102	0·2	0·190	0·190	0·188
0·005	0·757	0·3	0·171	0·165	0·162	0·153	0·138	0·145	0·01377	0·078	0·3	0·166	0·164	0·163
0·01	0·682	0·4	0·155	0·149	0·146	0·139	0·125	0·129	0·02662	0·059	0·4	0·152	0·149	0·147
0·02	0·594	0·5	0·145	0·139	0·137	0·130	0·116	0·117	0·03796	0·051	0·5	0·141	0·139	0·136
0·05	0·465	0·6	0·138	0·131	0·129	0·122	0·110	0·107	0·1437	0·0269	0·6	0·134	0·132	0·129
0·1	0·369	0·7	0·132	0·125	0·124	0·117	0·105	0·101	0·5014	0·0175	0·7	0·129	0·127	0·124
0·2	0·282	0·8	0·128	0·121	0·120	0·117	0·102	0·096	0·8715	0·0132	0·8	0·125	0·123	0·120
0·4	0·209	1	0·122	0·115	0·114	0·108	0·097	0·088			0·9	0·122	0·119	0·117
		2	0·117	0·110	0·109	0·104	0·093	0·076			1·00	0·119	0·116	0·114
		3	0·128	0·121	0·122	0·118	0·104	0·079						
		4	0·151	0·143	0·145	0·140	0·123	0·089						
		6	0·234	0·209	0·218	0·218	0·179	0·141						
		8	0·351	0·314	0·317	0·332		0·217						

27 STOICHIOMETRIC MEAN MOLAL ACTIVITY COEFFICIENTS OF SALTS IN METHANOL+WATER MIXTURES AT 25°C

Wt % Methanol	KCl				LiCl					NaCl			
	0·02*m*	0·05*m*	0·1*m*	0·5*m*	0·02*m*	0·05*m*	0·1*m*	0·5*m*	1·0*m*	0·02*m*	0·05*m*	0·2*m*	0·5*m*
10	0·831	0·769	0·716	0·611	0·854	0·792	0·750	0·689	0·727	0·852	0·795	0·699	0·643
20	0·796	0·726	0·672	0·585	0·836	0·760	0·716	0·645	0·684	0·827	0·763	0·664	0·606
30	0·749	0·674	0·620	0·552	0·815	0·730	0·683	0·603	0·643	0·804	0·732	0·630	0·571
40	0·691	0·609	0·556	0·506	0·790	0·695	0·645	0·557	0·599	0·773	0·696	0·591	0·532
50	0·646	0·566	0·516	0·484	0·757	0·661	0·605	0·516	0·552	0·735	0·655	0·545	0·488
60	0·515	0·443	0·402	0·385	0·709	0·616	0·555	0·454	0·496	0·678	0·599	0·486	0·430
70	0·417	0·351	0·316		0·674	0·563	0·497	0·403	0·435	0·645	0·552	0·443	0·388
80	0·312	0·257	0·229		0·602	0·510	0·427	0·334	0·363	0·563	0·479	0·362	0·318
90	0·197	0·156	0·139		0·542	0·426	0·352	0·261	0·287	0·493	0·401	0·298	

28 THERMODYNAMIC PROPERTIES OF HYDROCHLORIC ACID SOLUTIONS IN WATER

m = molality of HCl (moles per 1000 g water)
$\bar{L}_1$ = relative partial molal heat content of H_2O
J_1 = relative partial molal heat capacity of H_2O
a_1 = activity of H_2O
$\bar{L}_2$ = relative partial molal heat content of HCl
J_2 = relative partial molal heat capacity of HCl
$\bar{S}_2-\bar{S}_2^\circ$ = relative partial molal entropy of HCl
$\bar{S}_1-\bar{S}_1^\circ$ = relative partial molal entropy of H_2O

Stoichiometric Mean Molal Activity Coefficient of Hydrochloric Acid ($\gamma\pm$)								
m	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C
0·0001	(0·9890)	(0·9886)	(0·9890)	(0·9890)	(0·9892)	(0·9891)	(0·9890)	(0·9886)
0·0002	(0·9848)	(0·9847)	(0·9846)	(0·9844)	(0·9844)	(0·9842)	(0·9835)	(0·9838)
0·0005	(0·9756)	(0·9756)	(0·9756)	(0·9757)	(0·9759)	(0·9752)	(0·9747)	(0·9745)
0·001	(0·9668)	(0·9662)	(0·9666)	(0·9661)	(0·9661)	(0·9656)	(0·9650)	(0·9647)
0·002	0·9541	0·9539	0·9544	0·9530	0·9527	0·9521	0·9515	0·9513
0·005	0·9303	0·9300	0·9300	0·9297	0·9294	0·9285	0·9275	0·9268
0·01	0·9065	0·9056	0·9055	0·9055	0·9052	0·9048	0·9034	0·9025
0·02	0·8774	0·8768	0·8773	0·8770	0·8768	0·8755	0·8741	0·8731
0·05	0·8346	0·8344	0·8338	0·8329	0·8317	0·8304	0·8285	0·8265
0·1	0·8027	0·8023	0·8016	0·8000	0·7985	0·7964	0·7940	0·7918
0·2	0·7756	0·7756	0·7740	0·7717	0·7694	0·7667	0·7630	0·7604
0·5	0·7761	0·7730	0·7694	0·7658	0·7616	0·7571	0·7526	0·7477
1·0	0·8419	0·8363	0·8295	0·8229	0·8162	0·8090	0·8018	0·7942
1·5	0·9452	0·9365	0·9270	0·9154	0·9065	0·8962	0·8849	0·8740
2·0	1·078	1·068	1·053	1·039	1·024	1·009	0·9929	0·9755
3·0	1·452	1·427	1·401	1·373	1·345	1·316		
4·0	2·006	1·960	1·911	1·862	1·812	1·762		

	Stoichiometric Mean Molal Activity Coefficient of HydrochloricAcid ($\gamma\pm$)					$\bar{L}_2 = \bar{L}_2\,(0^\circ)-\alpha t+\beta t^2$		
m	40°C	45°C	50°C	55°C	60°C	$\bar{L}_2\,(0^\circ)$	α	β
0·0001	(0·9885)	(0·9883)	(0·9879)	(0·9879)	(0·9879)			
0·0002	(0·9833)	(0·9835)	(0·9831)	(0·9833)	(0·9831)			
0·0005	(0·9741)	(0·9741)	(0·9738)	(0·9735)	(0·9734)			
0·001	(0·9643)	(0·9644)	(0·9639)	(0·9636)	(0·9632)			
0·002	0·9505	0·9504	0·9500	0·9497	0·9491			
0·005	0·9265	0·9261	0·9250	0·9240	0·9235	28	0·70	0·003
0·01	0·9016	0·9008	0·9000	0·8990	0·8987	39	1·00	0·003
0·02	0·8715	0·8704	0·8690	0·8680	0·8666	52	1·30	0·004
0·05	0·8246	0·8232	0·8211	0·8195	0·8168	82	1·85	0·006
0·1	0·7891	0·7872	0·7850	0·7829	0·7813	113	2·50	0·008
0·2	0·7569	0·7538	0·7508	0·7474	0·7437	159	3·20	0·009
0·5	0·7432	0·7387	0·7344	0·7292	0·7237	272	4·70	0·011
1·0	0·7865	0·7790	0·7697	0·7628	0·7541	427	6·80	0·015
1·5	0·8601	0·8517	0·8404	0·8276	0·8178	615	8·20	0·019
2·0	0·9602	0·9481	0·9327	0·9186	0·9072	791	10·00	0·023
3·0						1175	12·45	0·031
4·0						1604	14·70	0·040

Table 28 (*cont.*)

	Stoichiometric Mean Molal Activity Coefficient of Hydrochloric Acid ($\gamma\pm$)						$\bar{L}_2$ cal mole^{-1}					
m	0°C	10°C	20°C	30°C	40°C	50°C	0°C	10°C	20°C	30°C	40°C	50°C
3	1·427	1·373	1·320	1·267	1·213	1·161	1159	1284	1418	1561	1713	1875
4	1·974	1·876	1·779	1·686	1·594	1·505	1566	1723	1889	2066	2255	2454
5	2·771	2·597	2·431	2·272	2·118	1·972	1969	2158	2357	2568	2791	3027
6	3·910	3·615	3·336	3·075	2·829	2·598	2371	2590	2822	3066	3323	3596
7	5·512	5·024	4·574	4·159	3·771	3·418	2771	3021	3285	3562	3853	4161
8	7·721	6·942	6·234	5·591	5·000	4·467	3170	3452	3747	4056	4381	4723
9	10·71	9·497	8·414	7·444	6·569	5·788	3570	3881	4207	4550	4909	5285
10	14·66	12·83	11·21	9·790	8·523	7·411	3969	4310	4668	5042	5435	5847
11	19·78	17·08	14·73	12·70	10·91	9·358	4368	4738	5127	5534	5961	6407
12	26·28	22·41	19·06	16·21	13·74	11·63	4765	5167	5587	6026	6485	6966
13	34·41	28·93	24·30	20·37	17·04	14·22	5163	5594	6046	6517	7009	7525
14	44·42	36·83	30·49	25·22	20·79	17·12	5561	6022	6504	7008	7533	8084
15	56·70	46·30	37·76	30·75	24·98	20·25	5958	6449	6962	7498	8057	8642
16	71·76	57·65	46·24	37·04	29·59	23·60	6355	6876	7420	7988	8581	9199

	$\bar{S}_2-\bar{S}_2^\circ$ cal mole^{-1} deg^{-1}						$\bar{J}_2=\bar{C}_{p_2}-\bar{C}_{p_2}^\circ$ cal mole^{-1} deg^{-1}					
m	0°C	10°C	20°C	30°C	40°C	50°C	0°C	10°C	20°C	30°C	40°C	50°C
3	1·538	1·095	0·634	0·162	−0·332	−0·839	12·27	13·06	13·89	14·79	15·76	16·80
4	2·486	1·928	1·361	0·775	0·166	−0·458	15·39	16·31	17·28	18·31	19·42	20·59
5	3·244	2·575	1·890	1·191	0·473	−0·266	18·46	19·50	20·60	21·76	22·99	24·29
6	3·867	3·087	2·289	1·478	0·648	−0·207	21·49	22·64	23·86	25·13	26·49	27·92
7	4·379	3·486	2·576	1·656	0·712	−0·254	24·49	25·77	27·11	28·50	29·98	31·53
8	4·793	3·783	2·763	1·732	0·677	−0·396	27·48	28·88	30·33	31·84	33·44	35·11
9	5·097	3·981	2·856	1·709	0·546	−0·637	30·44	31·95	33·52	35·14	36·86	38·65
10	5·302	4·080	2·845	1·597	0·319	−0·975	33·41	35·03	36·71	38·45	40·28	42·18
11	5·412	4·087	2·743	1·386	0·000	−1·399	36·37	38·10	39·89	41·75	43·68	45·70
12	5·434	3·995	2·545	1·079	−0·409	−1·919	39·32	41·15	43·06	45·02	47·07	49·20
13	5·368	3·822	2·258	0·686	−0·907	−2·532	42·26	44·21	46·22	48·30	50·46	52·70
14	5·221	3·568	1·897	0·208	−1·495	−3·231	45·19	47·26	49·39	51·57	53·85	56·20
15	5·013	3·242	1·457	−0·343	−2·165	−4·014	48·13	50·30	52·54	54·84	57·22	59·69
16	4·753	2·861	0·955	−0·963	−2·909	−4·871	51·06	53·35	55·69	58·10	60·59	63·17

Table 28 (cont.)

	$-\log_{10} a_1$						$-\bar{L}_1$ cal mole^{-1}					
m	0°C	10°C	20°C	30°C	40°C	50°C	0°C	10°C	20°C	30°C	40°C	50°C
3	0·0565	0·0556	0·0546	0·0536	0·0525	0·0514	33·42	36·85	40·59	44·57	48·82	53·34
4	0·0892	0·0876	0·0859	0·0841	0·0823	0·0805	58·17	63·71	69·54	75·71	82·24	89·14
5	0·1282	0·1256	0·1225	0·1202	0·1174	0·1146	91·11	99·24	107·8	116·8	126·2	136·2
6	0·1730	0·1692	0·1653	0·1614	0·1574	0·1534	131·9	143·2	155·1	167·5	180·5	194·1
7	0·2231	0·2179	0·2126	0·2073	0·2018	0·1964	180·1	195·2	210·9	227·3	244·4	262·4
8	0·2779	0·2711	0·2642	0·2572	0·2501	0·2431	235·3	254·5	274·6	295·5	317·4	340·2
9	0·3367	0·3281	0·3193	0·3106	0·3017	0·2928	296·9	320·8	345·8	371·8	398·9	427·2
10	0·3987	0·3881	0·3774	0·3666	0·3558	0·3448	364·8	393·9	424·2	455·8	488·6	522·8
11	0·4632	0·4505	0·4376	0·4246	0·4116	0·3984	439·2	474·0	510·1	547·8	586·9	627·6
12	0·5297	0·5147	0·4993	0·4839	0·4688	0·4529	521·0	562·0	604·6	648·9	694·9	742·8
13	0·5977	0·5801	0·5620	0·5440	0·5259	0·5076	611·8	659·6	709·4	761·0	814·7	870·4
14	0·6670	0·6466	0·6254	0·6046	0·5833	0·5620	713·9	769·5	827·2	881·6	949·3	1013·9
15	0·7377	0·7140	0·6893	0·6648	0·6404	0·6155	831·2	895·5	962·4	1031·8	1103·8	1178·5
16	0·8102	0·7827	0·7539	0·7255	0·6969	0·6679	968·1	1042·7	1120·3	1200·7	1284·2	1370·7

	$-\bar{J}_1 = -(\bar{C}_{p_1} - \bar{C}_{p_1}{}^{\circ})$ cal mole^{-1} deg^{-1}						$\bar{S}_1 - \bar{S}_1{}^{\circ}$ cal mole^{-1} deg^{-1}					
m	0°C	10°C	20°C	30°C	40°C	50°C	0°C	10°C	20°C	30°C	40°C	50°C
3	0·344	0·366	0·389	0·413	0·439	0·460	0·1366	0·1247	0·1112	0·0983	0·0846	0·0715
4	0·541	0·571	0·603	0·637	0·672	0·710	0·1955	0·1759	0·1563	0·1356	0·1143	0·0928
5	0·796	0·837	0·879	0·924	0·971	1·020	0·2534	0·2246	0·1927	0·1650	0·1344	0·1030
6	1·107	1·160	1·216	1·273	1·333	1·395	0·3094	0·2688	0·2303	0·1864	0·1440	0·1015
7	1·472	1·539	1·609	1·681	1·756	1·834	0·3621	0·3084	0·2538	0·1989	0·1437	0·0870
8	1·886	1·970	2·056	2·144	2·236	2·331	0·4108	0·3423	0·2692	0·2026	0·1312	0·0600
9	2·347	2·449	2·553	2·660	2·769	2·882	0·4544	0·3691	0·2825	0·1953	0·1076	0·0186
10	2·854	2·975	3·099	3·225	3·355	3·488	0·4896	0·3854	0·2808	0·1745	0·0683	−0·0390
11	3·408	3·551	3·695	3·843	3·995	4·149	0·5126	0·3885	0·2631	0·1369	0·0156	−0·1182
12	4·016	4·182	4·350	4·521	4·696	4·874	0·5177	0·3716	0·2235	0·0749	−0·0728	−0·2250
13	4·690	4·880	5·074	5·271	5·471	5·676	0·4965	0·3268	0·1528	−0·0198	−0·1942	−0·3695
14	5·446	5·665	5·887	6·112	6·342	6·575	0·4398	0·2458	0·0413	−0·1402	−0·3612	−0·5648
15	6·312	6·564	6·819	7·076	7·339	7·605	0·3343	0·1060	−0·1273	−0·3603	−0·5931	−0·8291
16	7·323	7·612	7·905	8·200	8·501	8·805	0·1644	−0·0993	−0·3705	−0·6394	−0·9106	−1·1869

29 THERMODYNAMIC PROPERTIES OF SODIUM HYDROXIDE SOLUTIONS IN WATER

$\gamma_{\pm}$ = Stoichiometric mean molal activity coefficient of NaOH. $\bar{L}_2$ = relative partial molal heat content of NaOH. $\bar{L}_1$ = relative partial molal heat content of H_2O. m = molality (moles per 1000 g water). a_1 = activity of water. $\bar{J}_2$ = relative partial molal heat capacity of NaOH. $\bar{J}_1$ = relative partial molal heat capacity of H_2O.

m	$\bar{L}_2$ cal mole^{-1}							
	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C
0·1	+9	+53	+103	+159	+223	+293	+373	+462
0·2	−60	+7	+85	172	272	384	509	648
0·4	−208	−102	+20	159	317	496	697	921
0·6	−345	−207	−48	134	341	575	840	1132
0·8	−463	−300	−110	107	358	638	956	1308
1·0	−565	−377	−162	86	371	692	1054	1456
1·5	−742	−511	−250	57	405	801	1245	1741
2	−823	−564	−275	67	454	893	1388	1939
3	−761	−477	−170	195	611	1079	1607	2193
4	−502	−207	+88	449	858	1319	1835	2409
5	−145	+162	+445	800	1203	1652	2154	2711
6	+237	+575	857	1228	1644	2104	2618	3184
7	+602	996	1300	1712	2174	2684	3249	3868
8	938	1411	1763	2248	2789	3385	4043	4764
9	1260	1834	2251	2832	3479	4188	4973	5829
10	1616	2297	2783	3467	4227	5060	5978	6982
11	2080	2862	3398	4166	5019	5954	6979	8099
12	2756	3603	4144	4950	5839	6805	7865	9018
13	3136	3842	4621	5482	6426	7455	8575	9789
14	3544	4277	5086	5977	6952	8012	9164	10411
15	3952	4713	5552	6471	7477	8568	9752	11032
16	4361	5150	6018	6966	8002	9125	10341	11653
17	4769	5587	6483	7461	8527	9681	10928	12272

m	$\bar{J}_2 = \bar{C}p_2 - \bar{C}p_2{}^{\circ}$ cal mole^{-1} deg^{-1}							
	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C
0·1	4·9	5·2	5·7	6·3	6·8	7·4	8·1	8·8
0·2	7·6	8·4	9·1	9·8	10·7	11·6	12·6	13·5
0·4	12·4	13·9	14·6	15·8	17·2	18·5	20·0	21·5
0·6	16·2	17·7	19·3	20·8	22·4	24·2	26·1	28·0
0·8	19·6	21·2	23·0	24·9	27·0	29·0	31·3	33·6
1·0	22·3	24·3	26·4	28·5	30·7	33·1	35·6	38·4
1·5	27·5	29·8	32·4	34·9	37·7	40·6	43·7	46·8
2	30·4	33·1	35·8	38·7	41·7	44·4	48·2	51·8
3	32·0	34·8	37·7	40·6	44·0	48·2	50·7	54·5
4	30·5	33·1	35·9	38·7	41·7	45·0	48·5	52·0
5	28·5	31·0	33·5	36·0	39·1	42·0	45·2	48·6
6	27·6	30·0	32·4	35·0	37·8	40·6	43·7	46·9
7	28·9	31·4	34·0	36·6	39·5	42·5	45·7	49·1
8	32·6	35·3	38·1	41·1	44·3	47·7	51·2	54·9
9	37·7	41·0	44·2	47·7	51·3	55·3	59·3	63·6
10	43·4	47·1	50·7	54·7	58·9	63·3	67·9	72·6
11	47·3	51·4	55·3	59·7	64·1	68·8	73·8	79·0
12	46·4	50·3	54·2	58·3	62·8	67·4	72·2	77·2

Table 29 (*cont.*)

m	$\log_{10}\gamma_{\pm}$							
	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C
0·1	−0·1056	−0·1056	−0·1065	−0·1079	−0·1100	−0·1126	−0·1163	−0·1205
0·2	−0·1316	−0·1306	−0·1311	−0·1322	−0·1347	−0·1381	−0·1429	−0·1488
0·4	−0·1578	−0·1547	−0·1541	−0·1548	−0·1574	−0·1616	−0·1681	−0·1762
0·6	−0·1713	−0·1663	−0·1648	−0·1646	−0·1672	−0·1719	−0·1797	−0·1895
0·8	−0·1786	−0·1720	−0·1694	−0·1688	−0·1713	−0·1765	−0·1851	−0·1963
1·0	−0·1821	−0·1738	−0·1706	−0·1696	−0·1719	−0·1774	−0·1868	−0·1993
1·5	−0·1823	−0·1684	−0·1644	−0·1626	−0·1649	−0·1713	−0·1822	−0·1970
2	−0·1664	−0·1539	−0·1495	−0·1475	−0·1503	−0·1573	−0·1695	−0·1858
3	−0·1172	−0·1048	−0·1028	−0·1020	−0·1063	−0·1152	−0·1296	−0·1482
4	−0·0458	−0·0360	−0·0382	−0·0406	−0·0479	−0·0594	−0·0760	−0·0969
5	+0·0426	+0·0484	+0·0405	+0·0337	+0·0225	+0·0073	−0·0126	−0·0365
6	+0·1438	+0·1451	+0·1309	+0·1189	+0·1028	+0·0828	+0·0582	+0·0298
7	0·2545	0·2514	0·2305	0·2131	0·1909	0·1649	+0·1344	+0·0996
8	0·3718	0·3646	0·3372	0·3134	0·2847	0·2517	0·2133	0·1708
9	0·4929	0·4816	0·4475	0·4171	0·3812	0·3399	0·2930	0·2407
10	0·6153	0·5994	0·5578	0·5204	0·4765	0·4266	0·3699	0·3075
11	0·7367	0·7148	0·6646	0·6191	0·5667	0·5076	0·4413	0·3688
12	0·8547	0·8242	0·7633	0·7085	0·6469	0·5786	0·5036	0·4226
13	0·9565	0·9075	0·8519	0·7900	0·7216	0·6469	0·5657	0·4781
14	1·0553	1·0003	0·9388	0·8710	0·7967	0·7161	0·6292	0·5358
15	1·1540	1·0930	1·0256	0·9519	0·8718	0·7854	0·6926	0·5935
16	1·2528	1·1858	1·1125	1·0329	0·9469	0·8546	0·7560	0·6511
17	1·3515	1·2786	1·1993	1·1138	1·0220	0·9238	0·8195	0·7088

m	$-\log_{10}a_1$							
	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C
0·1	0·0015	0·0015	0·0015	0·0015	0·0015	0·0015	0·0015	0·0015
0·2	0·0029	0·0029	0·0028	0·0028	0·0028	0·0028	0·0028	0·0028
0·4	0·0057	0·0058	0·0058	0·0058	0·0058	0·0058	0·0058	0·0058
0·6	0·0086	0·0086	0·0087	0·0087	0·0088	0·0088	0·0086	0·0086
0·8	0·0116	0·0116	0·0118	0·0117	0·0117	0·0117	0·0116	0·0115
1·0	0·0145	0·0147	0·0148	0·0149	0·0148	0·0148	0·0147	0·0146
1·5	0·0226	0·0230	0·0230	0·0230	0·0231	0·0229	0·0228	0·0226
2	0·0312	0·0316	0·0317	0·0317	0·0319	0·0316	0·0314	0·0311
3	0·0514	0·0516	0·0517	0·0516	0·0515	0·0511	0·0507	0·0502
4	0·0762	0·0761	0·0756	0·0751	0·0746	0·0739	0·0731	0·0723
5	0·1061	0·1055	0·1040	0·1027	0·1015	0·1002	0·0990	0·0978
6	0·1419	0·1403	0·1375	0·1355	0·1332	0·1310	0·1289	0·1265
7	0·1834	0·1809	0·1766	0·1730	0·1695	0·1659	0·1622	0·1585
8	0·2309	0·2272	0·2210	0·2158	0·2106	0·2050	0·1993	0·1935
9	0·2834	0·2786	0·2705	0·2633	0·2556	0·2478	0·2392	0·2306
10	0·3411	0·3347	0·3238	0·3143	0·3039	0·2929	0·2814	0·2691
11	0·4026	0·3939	0·3799	0·3672	0·3537	0·3392	0·3240	0·3078
12	0·4672	0·4548	0·4365	0·4199	0·4026	0·3844	0·3655	0·3458
13	0·5273	0·5122	0·4912	0·4720	0·4520	0·4312	0·4097	0·3874
14	0·5910	0·5731	0·5492	0·5271	0·5043	0·4806	0·4562	0·4311
15	0·6582	0·6371	0·6102	0·5849	0·5591	0·5324	0·5050	0·4768
16	0·7290	0·7046	0·6744	0·6459	0·6168	0·5867	0·5561	0·5248
17	0·8033	0·7754	0·7416	0·7096	0·6770	0·6435	0·6094	0·5746

Table 29 (*cont.*)

m	$-\bar{L}_1$ cal mole^{-1}							
	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C
0·1	0·0	0·0	0·0	0·1	0·1	0·1	0·2	0·2
0·2	−0·3	−0·2	−0·1	0·1	0·3	0·4	0·6	0·8
0·4	−1·0	−0·7	−0·3	0·0	0·4	1·0	1·6	2·2
0·6	−2·2	−1·6	−0·9	−0·2	0·6	1·5	2·8	4·2
0·8	−3·7	−2·8	−1·8	−0·6	0·9	2·5	4·3	6·3
1·0	−5·4	−4·2	−2·4	−1·0	1·0	3·4	6·0	8·8
1·5	−9·2	−7·1	−4·4	−1·6	2·0	5·8	10·3	15·1
2	−11·7	−8·6	−5·3	−1·3	3·5	8·6	14·6	21·2
3	−8·6	−4·3	−0·3	+4·7	10·6	17·1	24·4	32·6
4	+8·0	+12·8	+16·1	20·1	26·4	32·3	38·9	46·1
5	37·0	43·0	45·2	49·7	54·3	59·5	65·0	70·9
6	74·8	83·8	86·1	92·1	98·2	104·6	111·0	118·0
7	117·7	133·0	138·1	149·0	160·7	172·5	185·3	198·5
8	162·9	189·2	200·6	221·4	243·8	267·6	292·8	319·7
9	212·6	253·8	275·3	310·6	349·4	390·6	435·3	483·1
10	273·3	333·4	366·4	419·4	477·7	539·9	607·5	680·4
11	361·3	440·0	482·8	552·0	627·6	708·8	796·7	891·6
12	502·1	594·2	637·9	714·2	797·3	885·2	980·0	1081·5
13	593·8	692·3	742·6	825·7	915·7	1010·7	1112·7	1221·7
14	692·9	798·3	855·7	946·0	1043·5	1146·1	1256·0	1373·0
15	799·5	912·3	977·2	1075·3	1180·8	1291·6	1409·7	1535·2
16	913·6	1034·2	1107·3	1213·5	1327·5	1446·9	1573·9	1708·4
17	1035·4	1164·2	1245·8	1360·7	1483·7	1612·1	1748·6	1892·6

m	$-\bar{J}_1=-(Cp_1-\bar{C}p_1^{\circ})$ cal mole^{-1} deg^{-1}							
	0°C	10°C	20°C	30°C	40°C	50°C	60°C	70°C
0·1	0·001	0·002	0·002	0·002	0·003	0·001	0·002	0·002
0·2	0·008	0·008	0·007	0·008	0·008	0·009	0·010	0·010
0·4	0·029	0·031	0·034	0·036	0·040	0·042	0·044	0·047
0·6	0·066	0·072	0·078	0·083	0·090	0·095	0·100	0·107
0·8	0·115	0·124	0·134	0·143	0·152	0·163	0·174	0·178
1·0	0·168	0·182	0·198	0·211	0·213	0·241	0·255	0·272
1·5	0·319	0·346	0·372	0·399	0·426	0·455	0·484	0·515
2	0·475	0·513	0·552	0·591	0·634	0·676	0·719	0·763
3	0·733	0·790	0·847	0·909	0·972	1·035	1·099	1·167
4	0·925	0·994	1·066	1·145	1·214	1·292	1·371	1·451
5	1·137	1·221	1·305	1·392	1·482	1·574	1·667	1·765
6	1·526	1·637	1·748	1·866	1·982	2·105	2·229	2·356
7	2·240	2·405	2·568	2·741	2·918	3·100	3·286	3·477
8	3·381	3·637	3·889	4·154	4·427	4·707	4·995	5·293
9	4·939	5·316	5·690	6·084	6·491	6·910	7·340	7·784
10	6·737	7·255	7·772	8·314	8·877	9·455	10·049	10·663
11	8·387	9·033	9·675	10·351	11·054	11·774	12·517	13·281
12	9·220	9·928	10·623	11·359	12·122	12·905	13·712	14·543

THERMAL PROPERTIES OF ELECTROLYTES

m = molality of solute (moles per 1000 g water). $\bar{L}_1$ = relative partial molal heat content of solvent (cal mole^{-1}). $\bar{L}_2$ = relative partial molal heat content of solute (cal mole^{-1}). J_1 = relative partial molal heat capacity of solvent (cal deg^{-1} mole^{-1}). J_2 = relative partial molal heat capacity of solute (cal deg^{-1} mole^{-1}).

30 RELATIVE PARTIAL MOLAL HEAT CONTENT OF THE SOLUTE ($\bar{L}_2$) IN AQUEOUS SOLUTIONS AT 25°C (CAL MOLE^{-1})

$\sqrt{m}$	0·01	0·02	0·04	0·06	0·08	0·1	0·15	0·20	0·25	0·30
$BaBr_2$	33	64	118	169	214	251	317	372	412	439
$BaCl_2$	34	66	124	180	231	275	369	435	480	513
$Ba(NO_3)_2$	27	51	75	80	68	37	−65	−195	−352	−528
$CaBr_2$	34	65	120	172	219	260	340	410	462	498
$CaCl_2$	35	68	127	185	237	282	378	463	530	576
$Ca(NO_3)_2$	31	62	114	152	183	212	245	250	234	191
$CaSO_4$	80	208	418	588	712	802	882[b]			
$CdSO_4$	119	290	567	785	939	1071	1266	1380	1467	1542
Cs_2SO_4	29	57	102	136	161	176	172	152	124	87
$CuSO_4$	106	256	518	711	826	930	1115	1242	1321	1375
KBr	6·1	12·1	23·0	33	41	48	62	69	71	68
KCl	6·5	12·5	24·0	36	46	55	71	82	88	91
$KClO_3$	6·7	12·3	21·7	28	32	32	20	−6	−37	−77[a]
$KClO_4$	6·2	11·3	16·6	17	13	4	−34	−86	−148	−228[a]
KF	7·0	13·8	27·4	41	54	66	94	117	136	151
KNO_3	5·7	11·0	20·3	26	29	28	12	−17	−57	−103
K_2SO_4	32	62	119	164	200	226	262	272	266	233
LiBr	6·3	12·2	24·0	35	47	59	86	111	136	159
LiCl	6·4	12·5	24·7	37	49	60	89	115	141	165
Li_2SO_4	35	69	135	200	260	317	424	508	578	620
$MgBr_2$	34	67	125	181	233	278	372	453	519	564
$MgCl_2$	36	70	130	187	240	287	388	484	567	626
$Mg(NO_3)_2$	32	62	121	175	224	264	339	393	437	465
$MgSO_4$	79	191	380	525	631	715	865	937	951	
NH_4Cl	6·7	13	25	37	47	56	75	91	105	121[a]
NaBr	6·3	12·2	24·2	35	45	54	70	79	83	82
$NaBrO_3$	6·5	12·7	24·2	33	39	43	42	33	22	8[a]
NaCl	6·5	12·5	24·0	35	46	57	77	92	100	104
$NaClO_3$	6·6	12·9	24·4	34	41	47	55	55	45	27[a]
$NaIO_3$	5·8	11·0	19·8	24	24	20	0	−41	−88	−143[a]
$NaNO_3$	6·0	11·5	22·5	31	40	46	51	40	27	13[a]
Na_2SO_4	33	64	122	170	206	229	261	264	241	287
Rb_2SO_4	31	61	115	162	195	216	233	233	225	201
$SrBr_2$	33	64	119	170	216	254	324	383	423	452
$SrCl_2$	34	66	125	180	232	277	372	443	492	528
$Sr(NO_3)_2$	30	58	102	137	159	180	185	161	116	46
$ZnSO_4$	86	202	415	595	698	765	893	989	1064	1120

[a] At $\sqrt{m}$ = 0·3162. [b] At $\sqrt{m}$ = 0·125.

Table 30 (*cont.*)

m	KBr	KCl	KF	LiBr	LiCl	NaBr	NaCl
0·1	70	91	155	166	173	78	102
0·2	39	72	179	223	234	58	90
0·3	1	44	190	267	279	31	62
0·4	−42	12	197	305	318	2	28
0·5	−89	−21	203	339	352	−30	−10
0·6	−136	−55	209	371	384	−66	−48
0·7	−180	−85	215	400	413	−100	−85
0·8	−224	−115	220	424	440	−136	−120
0·9	−268	−146	226	448	467	−173	−156
1·0	−309	−176	231	471	491	−206	−188
1·2	−390	−233	240	515	540	−280	−252
1·5	−507	−316	254	580	614	−382	−343
1·7	−579	−370	262	625	665	−448	−398
2·0	−678	−446	274	696	744	−538	−466
2·5	−823	−558	291	821	855	−654	−556
3·0	−956	−648	318	960	1044	−751	−626
3·5	−1076	−721	376	1097	1205	−832	−671
4·0	−1181	−782	456	1237	1375	−897	−688
4·5	−1269	−828	546	1386	1524	−945	−683
5·0	−1345	−853[d]	643	1544	1743	−981	−656
5·5	−1392		754	1700	1947	−1001	−620
6·0	−1412[e]		884	1865	2163	−992	−570[c]

[c] For saturated solution m = 6·12. [d] For saturated solution m = 4·82. [e] For saturated solution m = 5·68.

32 RELATIVE PARTIAL MOLAL HEAT CONTENT FOR Cd SALT SOLUTIONS ($\bar{L}_2$ cal mole^{-1})

m	$CdCl_2$		$CdBr_2$		CdI_2	
	15°	25°C	15°C	25°C	15°C	25°C
0·0001	47	67	−4	6	−287	−157
0·0005	112	157	−74	−7	−819	−564
0·001	162	232	−134	−23	−1148	−828
0·005	362	634	−343	−108	−2155	−1587
0·01	472	759	−414	−131	−2622	−1941
0·05	702	993	−540	−127	−3700	−2789
0·1	778	1134	−591	−70	−4074	−3108
0·2	860	1323	−639	−9		
0·4			−686	−5		

31 THERMAL PROPERTIES OF SOLVENT AND SOLUTE FOR $CeCl_3$ AND $NdCl_3$ AT 25°C

$\sqrt{m}$	$CeCl_3$			
	$\bar{L}_1$	$\bar{L}_2$	J_1	J_2
0·01	$6·1 \times 10^{-5}$	102	$8·2 \times 10^{-7}$	1·4
0·02	$4·7 \times 10^{-4}$	200	$6·6 \times 10^{-6}$	2·4
0·05	$6·8 \times 10^{-3}$	475	$1·0 \times 10^{-4}$	6·9
0·1	0·0474	868	$8·23 \times 10^{-4}$	13·8
0·2	0·2843	1457	$6·58 \times 10^{-3}$	27·6
0·3	0·7315	1858	0·0222	41·5
0·4	1·407	2164	0·0527	55·3
0·5	2·523	2468	0·103	69·1
0·6	4·690	2860	0·178	82·9

$\sqrt{m}$	$NdCl_3$			
	$\bar{L}_1$	$\bar{L}_2$	J_1	J_2
0·01	$6·1 \times 10^{-5}$	102	$8·3 \times 10^{-7}$	1·4
0·02	$4·7 \times 10^{-4}$	200	$6·7 \times 10^{-6}$	2·8
0·05	$6·7 \times 10^{-3}$	470	$1·0 \times 10^{-4}$	6·9
0·1	0·0456	848	$8·34 \times 10^{-4}$	13·9
0·2	0·2606	1387	$6·67 \times 10^{-3}$	27·8
0·3	0·6233	1722	0·0225	41·7
0·4	1·159	1959	0·0534	55·5
0·5	2·078	2206	0·104	69·4
0·6	4·099	2567	0·180	83·3

33 HEAT CONTENT AND HEAT CAPACITY DATA FOR NaCl IN AQUEOUS SOLUTION AT VARIOUS TEMPERATURES

m	$\bar{L}_2$ cal mole^{-1}											$J_2 = (\bar{C}p_2 - \bar{C}p_2^\circ)$			
	0°C	10°C	20°C	25°C	30°C	40°C	60°	70°	80°	90°C	100°	0°C	15°	25°	60°
0·5	−330	−185	−90	−45	+15	+170	300	400	500	600	700	10	10	10	10
1·0	−630	−440	−250	−180	−100	+30	310	430	550	670	760	20	18	16	12
1·5	−860	−680	−430	−330	−260	−60	240	420	580	720	800	25	23	20	15
2·0	−1120	−840	−560	−450	−330	−130	280	450	650	820	1020	33	28	24	19
2·5	−1300	−1070	−710	−560	−380	−140	240	480	700	890	1040	35	34	32	21
3·0	−1650	−1190	−770	−580	−400	−150	300	500	730	910	1040	45	42	35	21
3·5	−1800	−1230	−800	−590	−420	−170	310	520	820	960	1120	51	45	38	22
4·0	−1850	−1380	−850	−620	−440	−150	360	590	890	1000	1300	53	51	41	24

34 THERMAL PROPERTIES OF SOLVENT AND SOLUTE FOR $LaCl_3$ AND $La_2(SO_4)_3$ AT 25°C

m	$LaCl_3$		$La_2(SO_4)_3$	
	$-\bar{L}_1$	$\bar{L}_2$	$-\bar{L}_1$	$\bar{L}_2$
0·00005			$1·09 \times 10^{-3}$	4130
0·0001	$3·56 \times 10^{-5}$	55	$2·59 \times 10^{-3}$	5280
0·0005	$5·00 \times 10^{-4}$	146	0·0125	7535
0·001	$1·63 \times 10^{-3}$	231	0·0213	8250
0·005			0·0640	9130
0·01	0·0408	763	0·108	9660
0·02	0·0980	986	0·288	10280
0·05	0·249	1147		
0·1	0·268	1277		

35 AQUEOUS HBr AT 25°C

m	$\bar{L}_2$	$\bar{J}_2$
0·001	22	0·4
0·005	47	0·8
0·01	64	1·0
0·02	85	1·5
0·05	124	2·2
0·1	163	2·9
0·2	222	3·9
0·5	338	5·6
1·0	500	7·7

36 INTEGRAL HEATS OF SOLUTION OF RARE EARTH CHLORIDES AT 25°C IN WATER

Constants for the equation (valid to m_{max}) $\Delta H = a + bm^{1/2} + cm$ (cal $mole^{-1}$)

Salt	$-a$	b	$-c$	m_{max}
$ErCl_3$	49792	6925	7873	0·06812
$GdCl_3$	42992	6925	4027	0·06350
$LaCl_3$	32933	6925	5640	0·08145
$PrCl_3$	35672	6925	5774	0·09351
$SmCl_3$	39932	6925	8949	0·09163
YCl_3	48690	6925	5223	0·08451
$YbCl_3$	51638	6925	5433	0·08815

37 HEAT CONTENT AND HEAT CAPACITY DATA FOR AQUEOUS SOLUTIONS OF HF AT 25°C

Wt % HF	5	10	15	20	25	30	35	40	45
$-\bar{L}_1$	1·42	6·54	19·5	53·9	106	185	312	498	694
$-\bar{L}_2$	3770	3700	3600	3430	3230	3000	2710	2370	2070
$-\bar{J}_1$	0·065	0·111	0·172	0·246	0·352	0·492	0·825	1·34	2·25
$-\bar{J}_2$	12·6	11·6	11·4	10·9	10·5	10·1	9·26	8·31	6·98

Wt % HF	50	55	60	65	70	75	80	85	90	95
$-\bar{L}_1$	919	1220	1560	1950	2410	2950	3410	4040	4600	5270
$-\bar{L}_2$	1790	1490	1220	961	716	488	339	190	100	44·4
$-\bar{J}_1$	3·10	3·96	5·10	6·27	7·70	9·18	11·1	13·5	15·0	17·0
$-\bar{J}_2$	5·96	5·03	4·07	3·32	2·56	1·94	1·30	0·737	0·423	0·176

38 CONSTANTS FOR THE EQUATIONS $\bar{L}_2 = \bar{L}_2(0°) + \alpha t + \beta t^2$ (cal $mole^{-1}$) AND $\bar{J}_2 = \alpha + \beta t$ (cal deg^{-1} $mole^{-1}$). Valid 0 to 40°C

m	KCl			KOH			NaBr			H_2SO_4 (valid 0–60°C)			
	$\bar{L}_2(0°)$	α	100β	$\bar{L}_2(0°)$	α	100β	$\bar{L}_2(0°)$	α	100β	m	$\bar{L}_2(0°)$	α	100β
0·05	(34)	2·0	1·4	37	2·4	1·7				0·0005	397	7·228	6·748
0·1	−15	3·5	2·5	41	3·6	2·9	−23	4·6	1·5	0·001	858	7·578	6·706
0·15				30	4·7	3·0				0·002	1481	7·038	6·664
0·2	−80	5·1	3·0				−140	8·2	2·3	0·005	2503	6·948	6·676
0·25				−1	6·4	3·2				0·01	3244	7·538	6·691
0·3	−190	7·5	3·4				−210	11·8	2·7	0·02	3729	7·328	6·713
0·35				−35	8·2	3·4				0·05	4192	7·128	6·628
0·5	−280	9·4	3·7	−95	10·4	3·6	−400	17·3	3·6	0·1	4672	7·748	6·712
0·7	−430	12·0	4·0				−580	21·8	4·4	0·2	4903	8·008	6·798
0·75				−180	13·6	4·0				0·5	5063	8·268	6·828
1·0	−570	14·4	4·5	−270	16·2	4·3	−830	23·5	4·9	1	5310	10·168	7·118
1·5	−760	18·4	4·9	−335	20·6	5·0	−1140	27·4	5·5	2	5766	11·068	7·658
2·0	−920	22·2	5·5	−381	24·6	5·7	−1390	30·6	6·1	3	6607	11·528	7·488
2·5	−1000	23·0	6·0	−390	28·2	6·3	−1600	33·6	6·6	4	7464	11·908	7·458
3·0	−1025	25·4	6·6	−356	31·5	7·0	−1790	37·0	7·3	6	9059	12·578	7·638
3·5	−1200	27·7	7·2	−335	34·5	7·8	−1940	41·4	7·9	8	10399	13·898	7·908
4·0	−1270	29·6	7·9	−226	37·4	8·1	−2020	43·2	8·6	10	11474	16·768	8·518
										12	12434	18·218	8·748
										14	13402	16·168	8·308
										16	14320	12·438	7·388
										17·5	14961	11·508	7·488

39 RELATIVE PARTIAL MOLAL HEAT CONTENT FOR H_2SO_4 ($\bar{L}_2$) IN ISO-PROPANOL + WATER MIXTURES (cal $mole^{-1}$)

m	5% iso-Propanol					10% iso-Propanol				
	5°C	10°C	15°C	20°C	25°C	5°C	10°C	15°C	20°C	25°C
0·05	4738	4910	5085	5263	5444	4109	4258	4410	4564	4722
0·1	5105	5290	5479	5671	5866	4393	4552	4715	4880	5048
0·2	5322	5515	5712	5911	6115	4720	4891	5065	5243	5423
0·3	5438	5636	5837	6041	6249	4892	5070	5251	5438	5622
0·4	5500	5700	5903	6110	6320	4983	5163	5348	5535	5725
0·5	5545	5746	5951	6160	6372	5030	5213	5399	5588	5780
0·6	5557	5758	5964	6172	6385	5062	5245	5432	5622	5816
0·7	5565	5767	5972	6182	6394	5082	5267	5455	5646	5840
0·8	5577	5779	5985	6195	6408	5091	5275	5464	5655	5850
0·9	5585	5788	5994	6204	6417	5113	5298	5487	5680	5875
1·00	5690	5897	6107	6321	6539	5156	5344	5534	5728	5925

40 CONSTANTS FOR THE EQUATIONS $\bar{L}_2 = \alpha+\beta T^2$ AND $\bar{J}_2 = 2\beta T$ (T IN °K) AND $\bar{L}_2$ AND $\bar{J}_2$ AT 25°C

$\bar{L}_2$ = Relative partial molal heat content of solute (cal mole^{-1}). $\bar{J}_2$ = Relative partial molal heat capacity of solute (cal deg^{-1} mole^{-1}).
m = molality (moles solute per 1000 g water).

m	HCl in Aqueous Dioxan. Valid 0°C to 50°C																Zinc Salts in Water. Valid 0°C to 40°C							
	20% wt. Dioxan				45% wt. Dioxan				70% wt. Dioxan				82% wt. Dioxan				$ZnCl_2$				ZnI_2			
	$-\alpha$	100β	$\bar{L}_2$	$\bar{J}_2$	$-\alpha$	100β	$\bar{L}_2$	$\bar{J}_2$	$-\alpha$	100β	$\bar{L}_2$	$\bar{J}_2$	$-\alpha$	β	$\bar{L}_2$	$\bar{J}_2$	$-\alpha$	β	$\bar{L}_2$	$\bar{J}_2$	$-\alpha$	$\beta\times10^4$	$\bar{L}_2$	$\bar{J}_2$
0·001									701	1·29	446	7·7	5190	0·0752	1493	44·8								
0·0015									862	1·57	533	9·4	5710	0·0824	1612	49·1								
0·002									994	1·80	606	10·7	6550	0·0930	1714	55·4								
0·003					640	0·923	180	5·5	1121	1·96	621	11·7	7800	0·1082	1815	64·5								
0·005	77	0·208	108	1·2	619	1·061	324	6·3	1233	2·28	793	13·6	9240	0·1258	1939	75·0	295	0·0060	237	4	739	106	204	6
0·007	77	0·254	149	1·5	630	1·154	395	6·9	1266	2·42	884	14·4	10100	0·1364	2021	81·3					848	125	259	7
0·01	72	0·277	169	1·7	609	1·223	478	7·3	1270	2·54	987	15·1	10500	0·1418	2101	84·5	718	0·0116	316	7	1152	166	324	10
0·02	77	0·346	235	2·1	651	1·408	600	8·4	1299	2·82	1207	16·8	11000	0·1488	2223	88·7	1540	0·0219	403	13	1719	240	413	15
0·03	87	0·393	262	2·3	669	1·500	664	8·9	1348	2·95	1273	17·6	11120	0·1510	2298	90·0	2140	0·0295	485	18	2095	291	488	18
0·05	87	0·438	302	2·6	703	1·638	753	9·8	1389	3·16	1419	18·8	11240	0·1538	2427	91·7	3380	0·0453	644	27	2623	360	576	22
0·07	96	0·485	335	2·9	735	1·730	802	10·2	1397	3·28	1518	19·6	11360	0·1560	2503	93·0	4400	0·0587	812	35	3009	411	640	25
0·1	144	0·554	348	3·3	754	1·823	866	10·9	1413	3·41	1617	20·3	11480	0·1589	2640	94·7	5700	0·0752	981	45	3381	461	720	28
0·2	298	0·808	420	4·8	839	2·077	1007	12·4	1417	3·71	1880	22·1	11860	0·1666	2945	99·3	9340	0·1224	1530	73	4291	586	917	35
0·3	435	1·015	467	6·1	934	2·284	1096	13·6	1477	3·97	2051	23·7	12200	0·1742	3280	103·9	12110	0·1639	2450	98				
0·5	682	1·384	548	8·3	1179	2·723	1241	16·2	1558	4·38	2334	26·1	12830	0·1880	3876	112·1	11760	0·1773	3990	106	6852	932	1432	56
0·7	871	1·684	625	10·0	1430	3·138	1359	18·7	1635	4·75	2586	28·3					11430	0·1846	4970	110	8740	1200	1922	72
1·0	1156	2·123	731	13·8	1704	3·646	1536	21·7	1697	5·19	2915	30·9					10290	0·1846	6110	110				
1·5	1517	2·723	903	16·2	1999	4·292	1815	25·6	1700	5·79	3445	34·5												
2·0	1753	3·207	1097	19·1	2169	4·799	2095	28·6																
3·0	2013	3·946	1494	23·5	2285	5·561	2657	33·1																

41 RELATIVE PARTIAL MOLAL HEAT CONTENT OF SOLUTE AND SOLVENT IN AQUEOUS SOLUTIONS OF AMINO ACIDS AT 25°C (cal mole^{-1})

m	CH_2NH_2COOH		m	$(CH_3)_2CNH_2COOH$		$CH_3CH_2CHNH_2COOH$		$CH_3CHNH_2CH_2COOH$		$CH_2NH_2CH_2CH_2COOH$	
	$\bar{L}_1$	$\bar{L}_2$		$-\bar{L}_1$	$\bar{L}_2$	$-\bar{L}_1$	$\bar{L}_2$	$-\bar{L}_1$	$\bar{L}_2$	$-\bar{L}_1$	$\bar{L}_2$
0·0005	-7×10^{-7}	0·2	0·0001	$3·0\times10^{-8}$	0·033	$2·3\times10^{-8}$	0·026	$2·1\times10^{-8}$	0·023	$2·4\times10^{-8}$	0·026
0·001	-3×10^{-6}	0·3	0·001	$3·0\times10^{-6}$	0·329	$2·3\times10^{-6}$	0·257	$2·1\times10^{-6}$	0·230	$2·4\times10^{-6}$	0·262
0·005	-5×10^{-5}	1·3	0·01	$3·0\times10^{-4}$	3·29	$2·3\times10^{-4}$	2·57	$2·1\times10^{-4}$	2·30	$2·4\times10^{-4}$	2·62
0·01	-2×10^{-4}	1·9	0·1	0·029	32·9	0·023	25·7	0·0207	23	0·024	26·2
0·05	+0·0041	−4·5	0·2	0·119	65·8	0·092	51·3	0·083	46	0·094	52·4
0·1	0·0226	−18·3	0·4	0·474	132	0·370	103	0·332	92	0·378	105
0·2	0·0732	−37·5	0·6	1·07	198	0·832	155	0·747	138	0·850	157
0·4	0·247	−69·6	0·8	1·90	263	1·48	204	1·33	184	1·51	210
0·8	0·900	−130	1·0	2·96	329	2·31	257	2·07	230	2·36	262
			1·2	4·27	395	3·33	308	2·99	276	3·40	314

m	$CH_3CH_2NH_2COOH$		$CH_3NH_2CH_2COOH$		m	$CH_3(CH_2)_2CHNH_2COOH$		$(CH_3)_2CHCHNH_2COOH$		$NH_2(CH_2)_5COOH$	
	$\bar{L}_1$	$\bar{L}_2$	$\bar{L}_1$	$\bar{L}_2$		$-\bar{L}_1$	$\bar{L}_2$	$-\bar{L}_1$	$\bar{L}_2$	$-\bar{L}_1$	$\bar{L}_2$
0·001	$+7·4\times10^{-6}$	−0·85	$-8·8\times10^{-7}$	0·10	0·001	$3·93\times10^{-6}$	0·436	$3·40\times10^{-6}$	0·378	$-1·2\times10^{-5}$	−1·58
0·005	$+1·0\times10^{-4}$	−2·82	$-2·2\times10^{-5}$	0·49	0·005	$9·83\times10^{-5}$	2·18	$8·50\times10^{-5}$	1·89	$-6·8\times10^{-5}$	−0·668
0·01	$+1·3\times10^{-4}$	−3·13	$-8·8\times10^{-5}$	0·97	0·01	$3·93\times10^{-4}$	4·36	$3·40\times10^{-4}$	3·78	$+5·22\times10^{-4}$	2·67
0·05	$-4·6\times10^{-3}$	+6·10	$-2·1\times10^{-3}$	4·75	0·05	$9·83\times10^{-3}$	21·8	$8·50\times10^{-3}$	18·9	$1·50\times10^{-2}$	32·3
0·075	$-7·1\times10^{-3}$	8·35	$-4·7\times10^{-3}$	7·02	0·1	0·0393	43·6	0·0340	37·8	0·0650	69·2
0·15	$-2·0\times10^{-2}$	14·37	−0·018	13·37	0·2	0·157	87·2	0·136	75·6	0·278	148
0·3	−0·077	28·57	−0·060	24·75	0·3	0·354	131	0·306	113	0·600	220
0·6	−0·31	57·14	−0·20	44·84	0·4	0·629	174	0·544	151	0·903	269
1·2	−1·2	114·3	−0·92	97·26	0·5	0·983	218	0·850	189		
					0·6	1·415	262	1·22	227		

42 THERMODYNAMIC ACID DISSOCIATION CONSTANTS

Those values marked *E* in column B, C* are constants for the equation $\log_{10} K = -A/T + \log_{10} T + C$; those values not marked are constants for the equation $\log_{10} K = -A^*/T + D^* - C^*T$. The solvent is water unless otherwise stated. The composition mixed solvents is expressed as weight % non-aqueous component. Concentrations in moles per 1000 g.

Acid solvent		0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C	45°C	50°C	*A* *A**	*C* *D**	*B* *C**	$\Delta G°$ 25°C	$\Delta H°$ 25°C	$-\Delta S°$ 25°C	$-\Delta C_p°$ 25°C
H_2O	$K \times 10^{15}$	1·139	1·846	2·920	4·505	6·809	10·08	14·69	20·89	29·19	40·18	54·74	4470·99	6·0875	0·01706	19088	13510	18·7	47
20% Dioxan	$K \times 10^{16}$	2·702	4·375	6·918	10·67	16·22	23·99	34·77	49·22	69·47	95·31	128·7	4596·78	6·3108	0·0184867	19940	13515	21·5	50·4
45% Dioxan	$K \times 10^{17}$	2·114	3·409	5·349	8·188	12·34	18·09	25·94	36·55	50·77	69·14	92·77	4641·08	5·7231	0·019784	21470	13190	27·8	54·0
70% Dioxan	$K \times 10^{19}$	1·789	2·819	4·348	6·511	9·654	13·95	19·74	27·43	37·79	50·64	67·19	4377·47	2·2289	0·018116	24353	12662	39·2	49·4
H_2CO_3	$K_1 \times 10^7$	2·64	3·04	3·44	3·81	4·16	4·45	4·71	4·90	5·04	5·13	5·19	3404·71	14·8435	0·032786	8663	2248	21·54	89·4
	$K_2 \times 10^{11}$	2·36	2·77	3·24	3·71	4·20	5·69	5·13	5·62	6·03	6·38	6·73	2902·39	6·4980	0·02379	14091	3603	35·17	64·9
0·1 *m* NaCl	$K_1 \times 10^7$	4·48	5·16	5·84	6·49	7·11	7·66	8·14	8·54	8·85	9·06	9·16	3266·11	14·0256	0·030811	8342	2411	19·89	84·1
0·2 *m* NaCl	$K_1 \times 10^7$	5·15	5·93	6·70	7·44	8·14	8·78	9·33	9·79	10·15	10·39	10·51	3228·50	13·8363	0·030401	8261	2406	19·64	82·9
0·5 *m* NaCl	$K_1 \times 10^7$	6·23	7·14	8·04	8·90	9·70	10·41	11·03	11·53	11·92	12·19	12·32	3158·38	13·5235	0·029892	8160	2292	19·68	81·6
0·7 *m* NaCl	$K_1 \times 10^7$	6·62	7·56	8·47	9·34	10·15	10·81	11·51	12·03	12·45	12·75	12·93	2955·23	12·2139	0·027721	8134	2200	19·75	75·6
1·0 *m* NaCl	$K_1 \times 10^7$	7·02	7·98	8·92	9·80	10·63	11·37	12·02	12·58	13·03	13·37	13·58	2786·18	11·1187	0·025885	8108	2219	19·75	70·6
HCOOH	$K \times 10^4$	1·638	1·691	1·728	1·749	1·765	1·772	1·76	1·747	1·716	1·685	1·650	2714·9	57·3914	21·03*E*	5119	−41	17·3	41·8
20% Dioxan	$K \times 10^5$	6·412	6·548	6·625	6·656	6·651	6·605	6·51	6·394	6·243	6·077	5·867	1339·04	5·0628	0·015983	5701	359	17·92	43·4
45% Dioxan	$K \times 10^6$	8·702	8·702	8·614	8·488	8·318	8·099	7·834	7·537	7·212	6·867	6·510	1333·79	4·6393	0·017634	6944	1067	19·72	48·1
70% Dioxan	$K \times 10^8$	11·08	10·88	10·64	10·35	10·01	9·634	9·213	8·778	8·310	7·842	7·359	1181·65	1·9920	0·016922	9569	1474	27·16	46·2
82% Dioxan	$K \times 10^9$		1·883	1·836	1·774	1·690	1·588	1·47	1·339	1·208	1·079		3006·85	13·2110	0·040005	12002	2509	31·84	109·1
MeCOOH	$K \times 10^5$	1·657	1·700	1·729	1·745	1·753	1·754	1·75	1·728	1·703	1·670	1·633	2394·6	49·4737	18·67*E*	6488	−105	22·1	37·1
20% Dioxan	$K \times 10^6$	4·75	4·87	4·98	5·05	5·09	5·11	5·08	5·03	4·95	4·86	4·73	1423·45	4·2934	0·016136	7217	−52	24·4	44·0
45% Dioxan	$K \times 10^7$	4·78	4·89	4·96	4·96	4·96	4·93	4·86	4·75	4·61	4·44	4·28	1568·31	4·5387	0·018736	8602	−442	30·3	51·1
70% Dioxan	$K \times 10^9$	4·75	4·83	4·89	4·83	4·83	4·78	4·69	4·56	4·42	4·22	4·05	1549·12	2·5194	0·018933	11348	−610	40·1	51·7
82% Dioxan	$K \times 10^{11}$		7·41	7·50	7·55	7·55	7·24	6·92	6·61	6·09	5·49		3763·40	16·0925	0·045641	13827	−1338	50·8	124·5
10% MeOH	$K \times 10^5$	1·138		1·200		1·242	1·247	1·23		1·214			1417·19	4·5806	0·015874	6690	30	22·3	43·3
20% MeOH	$K \times 10^6$	7·38		7·94		8·24	8·34	8·30		8·19			1572·21	5·3447	0·017279	6929	168	22·7	47·1
50% Glycerol	$K \times 10^6$	4·78	4·96	5·10	5·22	5·32	5·35	5·38	5·37	5·33	5·27	5·18	1321·43	3·4148	0·014268	7190	243	23·30	38·9
$MeCH_2COOH$	$K \times 10^5$	1·274	1·305	1·326	1·336	1·338	1·336	1·32	1·310	1·280	1·257	1·229	2384·6	49·4450	18·72*E*	6650	−180	22·6	37·2
20% Dioxan	$K \times 10^6$	3·175	3·267	3·337	3·385	3·412	3·417	3·40	3·370	3·319	3·252	3·172	1356·57	3·67038	0·015384	7455	−48	25·5	42·0
45% Dioxan	$K \times 10^7$	2·641	2·713	2·764	2·796	2·808	2·801	2·776	2·734	2·677	2·607	2·526	1480·12	3·52870	0·017163	8937	−206	30·7	46·8
70% Dioxan	$K \times 10^9$	2·299	2·364	2·410	2·439	2·450	2·444	2·422	2·386	2·336	2·274	2·202	1508·10	1·65390	0·017466	11746	−201	40·1	47·6
82% Dioxan	$K \times 10^{11}$		3·797	3·917	3·966	3·946	3·860	3·71	3·524	3·293	3·035		3680·11	15·05723	0·044030	14203	−1064	51·2	120·1
10% MeOH	$K \times 10^6$	8·81		8·85		9·17	9·47	9·09		8·38									
20% MeOH	$K \times 10^6$	6·03		6·08		5·86	5·78	5·53		5·25									
10% EtOH	$K \times 10^6$	8·70		9·00		9·00	9·00	9·06		9·02									
20% EtOH	$K \times 10^6$	6·73		7·55		7·71	7·81	7·88		7·80									
5% *iso*PrOH	$K \times 10^5$	1·015	1·038	1·052	1·061	1·060	1·053	1·04	1·032	1·012			1191·09	3·1909	0·013995	6789	−143	23·58	38·2
10% *iso*PrOH	$K \times 10^6$	7·80	8·03	8·15	8·23	8·24	8·20	8·12	8·00	7·85			1403·86	4·5143	0·016406	6937	−250	24·11	44·8
20% *iso*PrOH	$K \times 10^6$	4·13	4·48	4·59	4·66	4·66	4·66	4·62	4·54	4·44			1771·13	6·7087	0·020457	7272	−217	25·12	55·8
$Me(CH_2)_2COOH$	$K \times 10^5$	1·578		1·579		1·551	1·520	1·489		1·395		1·308	2136·8	46·1706	17·71*E*	6574	−716	24·5	35·2
5% *iso*PrOH	$K \times 10^5$	1·190	1·197	1·189	1·177	1·157	1·133	1·10	1·077	1·040			1048·52	2·67192	0·0137527	6745	−796	25·30	37·5
10% *iso*PrOH	$K \times 10^5$	0·922	0·929	0·925	0·916	0·907	0·888	0·86	0·839	0·813			1217·52	3·69027	0·0156246	6891	−785	25·74	42·6
20% *iso*PrOH	$K \times 10^5$	0·466	0·475	0·476	0·473	0·465	0·456	0·44	0·432	0·417			1459·37	5·01868	0·0183250	7284	−776	27·03	50·0
$Me(CH_2)_3COOH$	$K \times 10^5$	1·504		1·501		1·463	1·436	1·409		1·329		1·241	1987·1	42·7996	16·56*E*	6606	−720	24·6	32·9
$Me(CH_2)_4COOH$	$K \times 10^5$	1·445		1·448		1·416	1·390	1·364		1·287		1·201	2100·4	45·2436	17·40*E*	6625	−699	24·6	34·6
$Me_2CHCOOH$	$K \times 10^5$	1·497		1·489		1·447	1·417	1·38		1·301		1·208	2056·4	44·6839	17·23*E*	6614	−799	24·9	32·2

$\Delta G°$ and $\Delta H°$ in cal mole^{-1}. $\Delta S°$ and $\Delta Cp°$ in cal deg^{-1} mole^{-1}.

Table 42 (*cont.*)

For explanatory notes, see previous page

Acid solvent		0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C	45°C	50°C	*A* *A**	*C* *D**	*B* *C**	$\Delta G°$ 25°C	$\Delta H°$ 25°C	$-\Delta S°$ 25°C	$-\Delta C_p°$ 25°C
$Me_2CH_2CHCOOH$	$K \times 10^5$	1·879		1·810		1·709	1·657	1·605		1·477		1·345	1800·3	40·7503	15·96^{E}	6521	−1219	26·0	31·7
$MePrCHCOOH$	$K \times 10^5$	1·491		1·491		1·455	1·429	1·402		1·322		1·235	1972·5	42·4506	16·44^{E}	6610	−716	24·6	32·7
Me_3CCOOH	$K \times 10^5$	0·965		0·968		0·944	0·929	0·911		0·858		0·797	2275·1	49·0937	18·79^{E}	6865	−724	25·5	34·3
$Et_2CHCOOH$	$K \times 10^5$	2·384		2·169		1·948	1·835	1·744		1·540		1·353	1431·5	35·8971	14·48^{E}	6459	−2030	28·5	28·8
$(COOH)_2$	$K_2 \times 10^5$	5·91	5·82	5·70	5·55	5·40	5·18	4·92	4·67	4·41	4·09	3·83	1539·31	7·1966	0·021200	5846	−1577	24·9	57·8
$CH_2(COOH)_2$	$K_2 \times 10^6$	2·140	2·165	2·152	2·124	2·076	2·014	1·948	1·863	1·768	1·670	1·575	1703·31	6·5810	0·022014	7767	−1157	29·9	60·0
$(CH_2)_2(COOH)_2$	$K_1 \times 10^5$	5·20	5·46	5·70	5·88	6·07	6·21	6·34	6·45	6·50	6·51	6·52	2462·9	47·9882	17·755^{E}	5737	750	16·7	35·4
	$K_2 \times 10^6$	2·12	2·18	2·24	2·28	2·30	2·31	2·28	2·25	2·22	2·14	2·09	3756·1	79·2716	29·223^{E}	7691	−108	26·14	52·3
$(CHOH)_2(COOH)_2$	$K_1 \times 10^4$	7·62	8·04	8·41	8·77	9·04	9·20	9·44	9·57	9·59	9·55	9·53	1525·59	6·6558	0·015336	4141	741	11·40	40·6
	$K_2 \times 10^5$	3·75	3·92	4·06	4·16	4·25	4·31	4·32	4·30	4·25	4·17	4·06	1765·35	7·3015	0·019276	5955	237	19·19	52·6
CH_2COOH |	$K_1 \times 10^4$	6·03	6·31	6·69	6·92	7·21	7·45	7·66	7·78	7·96	7·99	8·04	1255·6	4·5635	0·011673	4268	997	11·0	31
COH |	$K_2 \times 10^5$	1·45	1·54	1·60	1·65	1·70	1·73	1·76	1·77	1·78	1·76	1·75	1585·2	5·4460	0·016399	6491	583	19·8	44
CH_2COOH	$K_3 \times 10^7$	4·05	4·11	4·14	4·13	4·09	4·02	3·99	3·78	3·69	3·45	3·28	1814·9	6·3664	0·022389	8726	−803	32·0	60
$CH_2OHCOOH$	$K \times 10^4$	1·334	(1·427 at $t=12·5°$)				1·475	(1·471	at $t=37·5°$)			1·415	1303·26	4·7845	0·014236	5225	175	16·9	38·8
$CH_3CHOHCOOH$	$K \times 10^4$	1·287	(1·361 at $t=12·5°$)				1·374	(1·336	at $t=37·5°$)			1·270	1304·72	4·9639	0·014926	5267	−99	18·0	40·7
$ClCH_2COOH$	$K \times 10^3$	1·528		1·488	(18° 1·440)		1·379	(32°	1·308)	1·230			1049·05	5·0273	0·014654	3901	−1158	17·0	40·0
H_3PO_4	$K_1 \times 10^3$	8·79	8·45	8·17	7·82	7·46	7·11	6·75	6·37	5·97	5·61	5·28	779·31	4·5535	0·013486	2930	1828	15·96	36·8
	$K_2 \times 10^8$	4·85	5·24	5·57	5·89	6·12	6·34	6·46	6·53	6·58	6·59	6·55	1979·5	5·3541	0·019840	9821	987	29·63	54·1
H_2SO_4	$K_2 \times 10^2$		1·73	1·58	1·43	1·20	1·03	0·90	0·78	0·67	0·57	0·50				2700	−5200	26·5	
10% MeOH	$K_2 \times 10^3$					5·50	4·70	4·05	3·50							3200	−5400	29·0	
20% MeOH	$K_2 \times 10^3$					2·55	2·20	1·90	1·65							3650	−5200	30·0	
HBO_2	$K \times 10^{10}$		3·63	4·17	4·72	5·25	5·80	6·35	6·86	7·38		8·32	2291·9	3·6865	0·017560	12597	3346	31·04	47·9
0·02 *m* NaCl	$K \times 10^{10}$		4·80	5·49	6·22	6·95	7·68	8·43	9·10	9·85	10·53	11·19	2221·1	3·2837	0·016595	12430	3415	30·24	45·3
0·07 *m* NaCl	$K \times 10^{10}$		5·79	6·61	7·50	8·38	9·25	10·16	11·04	11·91	12·76	13·55	2136·4	2·7805	0·015590	12320	3436	29·80	42·5
0·36 *m* NaCl	$K \times 10^{10}$		8·15	9·28	10·45	11·67	12·88	14·11	15·38	16·53	17·78	18·95	1881·8	1·2322	0·012782	12125	3413	29·22	34·9
0·725 *m* NaCl	$K \times 10^{10}$		9·45	10·68	11·99	13·31	14·73	16·16	17·56	19·00	20·38	21·77	1695·2	0·0750	0·010799	12044	3365	29·12	29·5
1·25 *m* NaCl	$K \times 10^{10}$		10·34	11·67	13·05	14·50	15·93	17·47	19·04	20·64	22·22	23·85	1496·2	−1·1962	0·008662	11998	3323	29·10	23·6
2·00 *m* NaCl	$K \times 10^{10}$		10·57	11·87	13·24	14·64	16·12	17·71	19·32	21·02	22·61	24·25	1264·9	−2·7439	0·006053	11990	3326	29·06	16·5
3·00 *m* NaCl	$K \times 10^{10}$		9·87	11·08	12·36	13·70	15·09	16·65	18·25	19·95	21·67	23·42	984·7	−4·7340	0·002626	12029	3438	28·82	7·2
NH_4^+	$K_A \times 10^{10}$	0·829	1·247	1·860	2·729	3·979	5·690	8·079	11·31	15·68	21·38	28·93	2716·5	−0·1306	0 ^{E}	12608	12428	0·60	0·0
60% MeOH[a]	$K_A \times 10^{10}$	3·35		7·41		16·2		32·4		64·6			2746	0·578	0 ^{E}	11770	12560	−2·65	0·0
$MeNH_3^+$	$K_A \times 10^{11}$	0·319		0·741		1·67		3·42		6·91		13·3	2344·2	−12·6576	^{E}	14484	13088	4·7	−8·0
60% MeOH[a]	$K_A \times 10^{11}$	2·34		5·50		12·0		24·8		49·0			3579	17·090	^{E}	13306	12790	1·73	12
$Me_2NH_2^+$	$K_A \times 10^{11}$	0·280		0·591		1·197		2·34		4·45		8·18	1091·5	−35·8162	^{E}	14687	11859	9·5	−23·1
Me_3NH^+	$K_A \times 10^{11}$	4·42		7·45		12·4		20·3		33·4		53·7	−920·6	−67·3233	^{E}	13358	8815	15·2	−43·8
$MeCH_2CH_2NH_3^+$	$K_A \times 10^{11}$	0·332		0·800		1·82	2·70	3·95		8·19		16·3	2520·2	−11·024	3·60 ^{E}	14419	13678	2·5	7·2
$MeCH_2CH_2CH_2NH_3^+$	$K_A \times 10^{11}$	0·270		0·664		1·54	2·29	3·38		7·08		14·1	2547·7	−11·424	3·77 ^{E}	14516	13893	2·1	7·5
$HOCH_2CH_2NH_3^+$	$K_A \times 10^{10}$	0·494	0·734	1·083	1·571	2·26	3·18	4·48	6·19	8·51	11·48	15·38	2677·91	0·3869	0·0004277	12953	12078	2·94	1·2
L-$C_6H_5CHOHCOCHMeNH_2Me^+$	$K_A \times 10^{10}$	0·556		1·148		2·13	2·92	3·96		7·13		12·88	270·0	−49·1120	16·36 ^{E}	13006	10925	7·00	−32·5
Dψ$C_6H_5CHOHCOCHMeNH_2Me^+$	$K_A \times 10^{10}$	0·352		0·703		1·368	1·92	2·61		4·76		8·81	1096·0	−32·1440	10·57 ^{E}	13254	11276	6·6	−21·0
$NH_3^+CH_2CH_2NH_3^+$	$K_{A1} \times 10^7$	0·273		0·542		1·035	1·42	1·92		3·44		6·01				9343	10870	−5·1	−17·5
	$K_{A2} \times 10^{10}$	0·194		0·414		0·841	1·18	1·65		3·09		5·60				13545	11820	5·8	−9·6
$NH_3^+(CH_2)_6NH_3^+$	$K_{A1} \times 10^{10}$	0·173		0·422		0·968	1·48	2·12		4·43		8·87				13411	13820	−1·3	−8·2
	$K_{A2} \times 10^{11}$	0·139		0·340		0·785	1·17	1·73		3·62		7·30				14912	13910	3·3	−8·4

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[a] On molarity scale.

Table 42 (*cont.*)

For explanatory notes, see pages 46 and 47

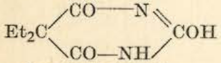
Acid solvent		0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C	45°C	50°C	A^*	D^*	C^*	ΔG° 25°C	ΔH° 25°C	$-\Delta S^\circ$ 25°C	$-\Delta G_p^\circ$ 25°C
C_6H_5COOH	$K \times 10^5$					6·237	6·295	6·266	6·237				1590·2	6·394	0·01765	5732	104	18·9	48·2
10% MeOH	$K \times 10^5$				4·00	4·07	4·10	4·10	4·07	4·03	3·96		1600·3	6·2367	0·01763		153	19·6	48·1
20% MeOH	$K \times 10^5$				1·86	1·89	1·90	1·90	1·88	1·86	1·83		1503·3	5·3016	0·01671		85	21·3	45·6
m-BrC_6H_4COOH	$K \times 10^4$				1·516	1·537	1·553	1·55	1·55	1·538	1·52					5913	−59	17·2	33
p-BrC_6H_4COOH	$K \times 10^5$				9·73	9·88	9·954	9·95	9·97	9·886	9·84					5456	107	17·9	31
m-ClC_6H_4COOH	$K \times 10^4$				1·45	1·476	1·50	1·49	1·43	1·48	1·47					5216	19	17·4	41
p-ClC_6H_4COOH	$K \times 10^4$				1·00	1·02	1·033	1·045	1·045	1·045	1·035					5434	226	17·5	23
m-CNC_6H_4COOH	$K \times 10^4$				2·463	2·518	2·526	2·533	2·516	2·48	2·44					4905	−29	16·3	47
p-CNC_6H_4COOH	$K \times 10^4$				2·77	2·812	2·812	2·799	2·79	2·748	2·713					4840	29	16·1	40
o-HOC_6H_4COOH	$K \times 10^4$	6·34		6·89		7·27	7·40	7·50		7·54		7·46	2628·3		19·37*E*	4271	550	12·48	38·5
p-HOC_6H_4COOH	$K \times 10^5$				2·53	2·60	2·62	2·655	2·647	2·63	2·61					6247	535	19·15	45
p-$NO_2C_6H_4COOH$	$K \times 10^4$				3·556	3·60	3·61	3·63	3·60	3·59	3·547					4694	74	15·5	30·5
o-$CH_3C_6H_4COOH$	$K \times 10^4$			1·473		1·323		1·172		1·055		0·949							
p-$HOC_6H_4SO_3H$	$K_2 \times 10^{10}$	4·45	5·20	6·03	6·92	7·85	8·85	9·89	10·94	12·00	13·09	14·16	1961·2	1·1436	0·012139	12347	4034	27·9	33·1
o-$C_6H_4(COOH)_2$	$K_1 \times 10^3$	1·190	1·182	1·171	1·157	1·141	1·123	1·102	1·078	1·053	1·027	0·998	561·57	1·2843	0·0078833	4024	−637	15·6	21·5
	$K_2 \times 10^6$	3·696	3·820	3·894	3·934	3·937	3·906	3·840	3·740	3·611	3·454	3·274	2175·83	9·55075	0·025694	7377	−496	26·4	70·1
	$K \times 10^9$	4·007	4·966	6·066	7·300	8·726	10·47	12·32	14·22	16·38	18·66	21·04	2324·47	3·3491	0·0118562				
p-$NH_2C_6H_4SO_3H$	$K \times 10^4$	3·016	3·488	4·003	4·588	5·218	5·925	6·668	7·482	8·341	9·249	10·25	1143·71	1·2979	0·0023142	4403	4291	0·38	6·3
NH_2SO_3H	$K \times 10^2$			9·31	9·55	10·1	10·3	10·5	10·4	10·0	9·44	9·20	3792·8	24·122	0·041544	1350	460	3·0	110
$NH_2CH_2CH_2SO_3H$	$K_{A2} \times 10^{10}$			3·532	4·829	6·524	8·682	11·49	15·01	19·40	24·88	31·67	2458·49	0·0997	0·0030689	12362	10000	7·91	8·4
$NH_3{}^+CH_2COOH$	$K_{A1} \times 10^3$		3·82	4·008	4·169	4·325	4·464	4·577	4·665	4·714	4·741	4·786	1332·17	5·8870	0·012643	3206	953	7·6	34·5
	$K_{A2} \times 10^{10}$			0·641	0·893	1·229	1·662	2·230	2·951	3·871	5·025	6·476	2686·95	0·5103	0·0042857	13340	10550	9·4	11·7
0·1 *m* NaCl	$K_{A1} \times 10^3$		3·79	3·97	4·14	4·29	4·43	4·54	4·63	4·70	4·75	4·77	1278·0	5·5030	0·011974	3210	977	7·49	32·7
0·3 *m* NaCl	$K_{A1} \times 10^3$		3·72	3·90	4·07	4·23	4·37	4·49	4·59	4·67	4·71	4·75	1292·4	5·5727	0·012067	3219	1005	7·43	32·9
0·725 *m* NaCl	$K_{A1} \times 10^3$		3·48	3·65	3·82	3·98	4·12	4·23	4·33	4·41	4·45	4·48	1297·4	5·5234	0·011931	3254	1083	7·28	32·6
1·25 *m* NaCl	$K_{A1} \times 10^3$		3·10	3·26	3·43	3·58	3·72	3·84	3·93	4·02	4·08	4·13	1277·1	5·2559	0·011412	3315	1201	7·09	31·1
2·00 *m* NaCl	$K_{A1} \times 10^3$		2·58	2·73	2·88	3·02	3·15	3·27	3·38	3·47	3·55	3·61	1213·1	4·6187	0·010234	3412	1388	6·79	27·9
3·00 *m* NaCl	$K_{A1} \times 10^3$		1·98	2·10	2·23	2·36	2·47	2·58	2·69	2·79	2·88	2·96	1026·6	3·0809	0·007529	3556	1635	6·44	20·5
20% Dioxan	$K_{A1} \times 10^3$	1·832	1·953	2·067	2·169	2·257	2·352	2·428	2·481	2·533	2·573	2·591	1368·94	5·6875	0·012493	3586	1183	8·1	34·1
45% Dioxan	$K_{A1} \times 10^4$	6·339	6·707	7·034	7·348	7·626	7·847	8·091	8·232	8·350	8·457	8·484	1273·49	4·7113	0·011887	4233	993	10·9	32·4
70% Dioxan	$K_{A1} \times 10^5$	8·933	9·350	9·759	10·01	10·43	10·84	10·98	11·15	11·26	11·36	11·39	1187·30	3·3894	0·011322	5412	829	15·4	30·9
NH_2CH_2COOH	$K_B \times 10^5$			4·68	5·12	5·57	6·04	6·52	6·98	7·43	7·87		1307·30	2·5629	0·008038	5754	2713	10·2	21·9
20% Dioxan	$K_B \times 10^5$	1·179	1·317	1·473	1·618	1·781	1·937	2·088	2·241	2·407	2·548	2·690	1519·89	3·3800	0·010046	6428	2869	11·9	27·4
45% Dioxan	$K_B \times 10^6$	1·789	2·024	2·272	2·541	2·840	3·120	3·408	3·707	4·015	4·342	4·680	1364·90	1·1999	0·007138	7511	3342	14·0	19·5
70% Dioxan	$K_B \times 10^7$	1·47	1·68	1·91	2·13	2·39	2·66	2·94	3·24	3·60	3·96	4·34	895·27	−3·328	0·000818	8968	3763	17·5	22·3
DL-CH_3CHNH_2COOH	$K_A \times 10^3$					4·47	4·57	4·66	4·71	4·74	4·76		1271·17	5·6650	0·012548	3191	714	8·3	34·2
	$K_B \times 10^5$					6·90	7·47	8·08	8·61	9·10	9·60		2069·10	7·7123	0·01643	5627	2787	9·5	44·8
$NH_2CH_2CH_2COOH$	$K_A \times 10^4$	2·21	2·36		2·61		2·81		2·99	3·04			1231·71	3·8478	0·010957	4843	1179	12·4	29·9
	$K_B \times 10^4$	1·14	1·25		1·51		1·73		1·92	2·02			1881·78	7·2558	0·015784	5131	2190	9·9	43·1
5% *iso*PrOH	$K_A \times 10^4$	1·93	2·08		2·33		2·52		2·69	2·73			1594·69	6·1904	0·014887	4906	1241	12·3	40·6
10% *iso*PrOH	$K_A \times 10^4$	1·69	1·83		2·07		2·28		2·42	2·48			1753·58	7·1209	0·016375	4969	1363	12·1	44·7
20% *iso*PrOH	$K_A \times 10^4$	1·32	1·46		1·70		1·89		2·03	2·07			2351·54	10·9051	0·022608	5078	1562	11·8	61·7
$NH_3{}^+(CH_2)_3COOH$	$K_1 \times 10^5$			8·768	8·997	9·162	9·307	9·406	9·439	9·393	9·348	9·290	1209·07	3·7820	0·012605	5500	405	17·0	34
	$K_2 \times 10^{11}$			0·942	1·370	1·969	2·782	3·898	5·378	7·352	9·942	13·37	2804·84	−0·5879	0·0018797	14401	12070	7·8	5

Table 42 (cont.)

For explanatory notes, see pages 46 and 47

Acid solvent		1°C	12·5 °C	25°C	37·5 °C	50°C	*A**	*D**	*C**	ΔG° 25°C	ΔH° 25°C	$-\Delta S^\circ$ 25°C	$-\Delta C_p^\circ$ 25°C
DL-CH$_3$CHNH$_2$COOH	$K_A\times10^3$	3·75	4·14	4·49	4·68	4·66	1383·06	6·3639	0·013661	3203	773	8·2	37·3
	$K_B\times10^5$	4·83	6·10	7·40	8·73	9·86	1529·44	4·2704	0·010966	5631	2539	10·4	29·9
DL-CH$_3$CH$_2$CHNH$_2$COOH	$K_A\times10^3$	4·63	4·90	5·18	5·15	5·05	1174·74	5·3735	0·012487	3123	298	9·5	34·1
	$K_B\times10^5$	4·25	5·50	6·81	8·22	9·38	1591·68	4·4429	0·010965	5681	2824	9·6	29·9
DL-CH$_3$CH$_2$CH$_2$CHNH$_2$COOH	$K_A\times10^3$	4·21	4·57	4·81	4·91	4·86	1222·02	5·5238	0·012553	3161	487	9·0	34·2
	$K_B\times10^5$	4·04	5·18	6·47	7·64	8·63	1852·42	6·2544	0·014191	5714	2685	10·1	38·7
DL-CH$_3$(CH$_2$)$_3$CHNH$_2$COOH	$K_A\times10^3$	4·04	4·41	4·62	4·74	4·70	1193·30	5·2850	0·012130	3183	528	8·9	33·1
	$K_B\times10^4$	4·41	5·62	6·87	8·05	9·16	1619·10	5·7984	0·011842	4314	2593	5·8	32·3
(CH$_3$)$_2$CNH$_2$COOH	$K_A\times10^3$	3·81	4·17	4·40	4·46	4·41	1344·95	6·3053	0·013924	3215	492	9·1	38·0
	$K_B\times10^4$	1·14	1·38	1·61	1·84	1·99	1460·04	4·5471	0·011540	5170	1988	10·7	31·5
DL-(CH$_3$)$_2$CHCHNH$_2$COOH	$K_A\times10^3$	3·79	5·05	5·18	5·11	4·90	1245·31	6·0251	0·013868	3118	59	10·3	37·8
	$K_B\times10^5$	3·24	4·21	5·27	6·28	7·28	1694·53	4·9842	0·012004	5835	2872	9·9	32·7
DL-(CH$_3$)$_2$CHCH$_2$CHCOOH |	$K_A\times10^3$	4·14	4·49	4·70	4·71	4·65	1283·60	6·0027	0·013505	3176	382	9·4	36·8
NH$_2$	$K_B\times10^5$	3·57	4·52	5·60	6·71	7·59	1651·61	4·8479	0·011933	5796	2705	10·4	32·5
DL-CH$_3$CH$_2$CHCHNH$_2$COOH |	$K_A\times10^3$	4·32	4·59	4·81	4·82	4·66	1298·09	6·1967	0·013959	3163	264	9·7	38·1
CH$_3$	$K_B\times10^5$	3·61	4·57	5·77	6·79	7·85	1537·47	4·0396	0·010482	5786	2772	10·1	28·6
NH$_3^+$CH$_2$CONHCH$_2$COOH	$K_1\times10^4$	6·30	6·82	7·11	7·11	7·11	1120·3	4·0802	0·011640	4291	391	12·9	31·2
	$K_2\times10^9$	1·14	2·55	5·60	11·3	21·5	2902·3	3·4932	0·006749	11260	10600	2·0	18·1
HOOCCH$_2$CHNH$_3^+$COOH	$K_1\times10^3$	7·55	8·83	10·2	11·4	12·4	1109·6	4·1563	0·008138	2720	1783	3·1	21·8
	$K_2\times10^5$	9·86	11·4	12·6	13·2	13·5	1706·3	6·7436	0·016506	5335	1110	14·2	44·2
	$K_3\times10^{11}$	2·49	4·97	9·95	18·1	30·8	2880·3	2·6890	0·010173	13650	9025	15·5	27·2
DI-HOCH$_2$CHNH$_3^+$COOH	$K_1\times10^3$	5·06	5·86	6·52	7·02	7·38	1311·2	5·6397	0·011496	2980	1366	5·4	30·8
	$K_2\times10^{10}$	1·32	2·87	6·19	12·5	23·6	2594·1	0·6031	0·003725	12550	10405	7·2	10·0
DL-CH$_3$CHOHCHNH$_3^+$COOH	$K_1\times10^3$	6·31	7·38	8·17	8·51	8·81	1716·1	8·5867	0·016504	2859	1180	5·6	44·2
	$K_2\times10^{10}$	1·79	3·80	7·94	15·4	28·3	2631·1	1·2866	0·005237	12410	9960	8·2	14·1
*allo*CH$_3$CHOHCHNH$_3^+$COOH	$K_1\times10^3$	6·64	7·28	7·80	8·13	8·20	1111·7	4·7982	0·010657	2871	772	7·0	28·6
	$K_2\times10^{10}$	1·68	3·70	8·02	16·0	30·2	2764·3	1·8531	0·005631	12400	10380	6·8	15·1
$^+$NH$_3$(CH$_2$)$_5$COOH	$K_1\times10^5$	3·80	4·10	4·24	4·13	3·89	1803·5	7·6874	0·020166	5965	−8	20·0	54·0
	$K_2\times10^{12}$	2·16	5·70	15·7	39·3	92·0	2708·6	−2·5445	−0·002757	14740	13560	4·0	−7·4
L-CH$_2$——CH$_2$ |	$K_1\times10^3$	9·75	10·9	11·2	11·2	11·0	1512·6	7·9217	0·016094	2663	342	7·8	43·1
CH$_2$—NH$_2^+$—CHCOOH	$K_2\times10^{12}$	5·06	10·7	22·9	45·5	86·3	2230·4	−3·1592	0·000010	14510	10310	14·1	0·0
L-HOCH———CH$_2$ | |	$K_1\times10^2$	1·26	1·41	1·52	1·59	1·64	1156·7	5·2753	0·010777	2476	918	5·2	28·8
CH$_2$—NH$_2^+$CHCOOH	$K_2\times10^{11}$	5·32	11·0	21·8	40·4	72·8	2442·9	−0·1266	0·004500	13160	9385	12·7	12·1

44 IONIC PRODUCT FOR D$_2$O IN PURE D$_2$O

Temperature	$K\times10^{16}$
15°C	8·3
25°C	19·5
35°C	42·7

At 25°C

ΔG° = 20,000 cal mole^{-1}

ΔH° = 14,420 cal mole^{-1}

ΔS° = −18·8 cal deg^{-1} mole^{-1}

43 DISSOCIATION CONSTANTS OF INORGANIC ACIDS IN AQUEOUS SOLUTION AT 25°C ($_{\mathrm{p}}$K = − log$_{10}$ K)

Acid		p*K*	Acid		p*K*	Acid		p*K*	Acid		p*K*	Acid		p*K*	Acid		p*K*
H$_3$AlO$_3$	pK_1	12·4	HBrO	pK	8·69		pK_2	12·72	H$_3$PO$_4$	pK_3	12·0	H$_2$SO$_3$	pK_1	1·90	H$_2$SiO$_3$	pK_1	10
H$_3$AsO$_4$	pK_1	3·60	HCN	pK	9·4	H$_5$IO$_6$	pK_1	3·29	H$_3$PO$_3$	pK_1	1·80		pK_2	7·25		pK_2	12
	pK_2	7·25	HCNO	pK	3·92		pK_2	6·70		pK_2	6·16	H$_2$S$_2$O$_4$	pK_1	0·35	H$_2$SnO$_2$	pK_1	14·42
	pK_3	12·52	HClO	pK	7·50		pK_3	15·0	H$_3$P$_3$O$_9$	pK_3	7·08		pK_2	2·46	H$_2$Te	pK_1	2·64
H$_3$AuO$_3$	pK_2	13·3	HClO$_2$	pK	1·96	H$_2$MnO$_2$	pK_1	19·0	H$_4$O$_4$O$_{12}$	pK_4	2·74	H$_2$S$_2$O$_3$	pK_1	0·6		pK_2	11·0
	pK_3	16·0	H$_2$CoO$_2$	pK_1	19·1	HNO$_2$	pK	3·35	H$_4$P$_2$O$_7$	pK_3	6·57		pK_2	1·72	H$_4$V$_6$O$_{17}$	pK_3	1·96
H$_3$BO$_3$	pK_1	9·22	H$_2$CrO$_4$	pK_2	6·50	H$_2$N$_2$O$_2$	pK_1	7·05		pK_4	9·62	H$_2$Se	pK_1	3·73	H$_2$ZnO$_2$	p(K_1K_2)	29·0
H$_2$B$_4$O$_7$	pK_1	4·0	HF	pK	3·17		pK_2	11·0	H$_3$PO$_2$	pK_1	2·0		pK_2	14·0	N$_2$H$_6^{2+}$	pK_1	−1·04
H$_2$Be$_2$O$_3$	p(K_1K_2)	29·14	H$_3$GaO$_3$	pK_2	10·32	HN$_3$	pK	4·74	H$_2$PbO$_2$	pK_1	10·92	H$_2$SeO$_3$	pK_1	2·57		pK_2	7·01
αH$_2$BeO$_2$	p(K_1K_2)	29·85		pK_3	11·7	H$_2$NiO$_2$	pK_1	18·22	H$_2$S	pK_1	6·96		pK_2	6·60	NH$_3$OH$^+$	pK	6·82
βH$_2$BeO$_2$	p(K_1K_2)	29·55	H$_2$GeO$_3$	pK_1	8·58	H$_2$OsO$_5$	pK_1	12·1		pK_2	14·0	H$_2$SeO$_4$	pK_2	2·05			

Concentrations in mole litre^{-1}

45 AVERAGE THERMODYNAMIC DISSOCIATION CONSTANTS FOR ION PAIRS (EXPRESSED AS p$K = -\log_{10} K$) AT 25°C IN AQUEOUS SOLUTION (Concentrations in mole litre $^{-1}$)

Anion	Cation								
	Mg^{2+}	Ca^{2+}	Sr^{2+}	Ba^{2+}	Cu^{2+}	Mn^{2+}	Zn^{2+}	La^{3+}	$Co(NH_3)_6^{3+}$
SO_4^{2-}	2·36	2·28			2·37	2·28	2·31	3·62	4·55
$S_2O_3^{2-}$	1·839	1·983	2·04	2·33		1·951	2·40		4·62
$P_3O_9^{3-}$	3·311	3·449	3·354	3·347		3·565		5·70	4·438
$P_4O_{12}^{4-}$	5·17	5·41	5·15	4·987				6·66	5·745
$HCOO^-$		0·80	0·66	0·60	1·98				
$MeCOO^-$	1·05	1·0	0·97	0·93	2·24		1·57		
$MeCH_2COO^-$	1·08	1·04	0·97	0·88	2·22		1·55		
$Me(CH_2)_2COO^-$	1·07	1·05	0·90	0·84	2·14		1·54		
Me_2CHCOO^-		0·51			2·17				
$Me(CH_2)_3COO^-$		0·3	−0·18	−0·20	2·12				
$Me_2CHCH_2COO^-$		0·20			2·08				
Me_3CCOO^-		0·55	0·14	0·08	2·19				
$(COO)_2^{2-}$	3·43	3·00	2·54	2·33	6·2	3·89	4·89		3·40
$CH_2(COO)_2^{2-}$	2·842	2·495		1·708	5·60	3·29	3·68	4·89	3·54
$(CH_2)_2(COO)_2^{2-}$	2·15	2·0		1·7	3·33		2·7	3·96	2·94
$(CH_2)_3(COO)_2^{2-}$	1·78	1·76		2·04	3·16		2·3	3·83	3·17
$(CH_2)_4(COO)_2^{2-}$		1·85		2·19	3·38			4·1	3·35
cis-$(CH)_2(COO)_2^{2-}$		2·26		2·43	3·90			4·55	4·21
tr-$(CH)_2(COO)_2^{2-}$		1·58		2·0	2·51			3·01	2·37
$CH_2CHOH(COO)_2^{2-}$	2·52	2·66		2·19			3·7		
$(CHOH)_2(COO)_2^{2-}$		2·54		2·80					
o-$C_6H_4(COO)_2^{2-}$		2·33		2·43	4·07			4·74	3·74
m-$C_6H_4(COO)_2^{2-}$		1·55		2·00					
$BrCH_2COO^-$		0·41	0·28	0·24	1·593				
$MeCHOHCH_2COO^-$	1·14	1·14	1·01	0·97			1·60		
$MeCHOHCOO^-$	1·37	1·44	0·979	0·64	2·92		2·027		
CH_2OHCOO^-	1·33	1·58	1·31	0·98	2·92				
$NH_2CH_2COO^-$	3·44	1·43	0·910	0·77	8·62	3·44	5·52		
$MeCHNH_2COO^-$	1·96	1·24	0·735	0·77	8·51	3·02	5·21		
$NH_2CH_2CONHCH_2COO^-$	1·06	1·24			6·04	2·15	3·80		

Anion	Cation			
	Co^{2+}	Ni^{2+}	Pb^{2+}	Ag^+
$NH_2CH_2COO^-$	5·23	6·18	5·47	3·51
$MeCHNH_2COO^-$	4·82	5·96	5·00	3·64
$NH_2CH_2CONHCH_2COO^-$	3·49	4·49	3·23	2·72

Cation	Anion	p*K*	Cation	Anion	p*K*
Ag^+	ClO_4^-	0·2	Ca^{2+}	$Fe(CN)_6^{3-}$	2·833
	NO_3^-	−0·29		$Fe(CN)_6^{4-}$	3·772
	OH^-	2·3		$H_2PO_4^-$	1·08
	SO_4^{2-} [a]	1·3		HPO_4^2	2·7
Ba^{2+}	$Fe(CN)_6^{3-}$	2·879		IO_3^-	0·89
	IO_3^-	1·0		NO_3^-	0·28
	NO_3^-	0·92		OH^-	1·40
	OH^-	0·64		$CaFe(CN)_6^{2-}$	1·43
				$H_2\mathit{Cit}^-$ [c]	1·2
				$H\mathit{Cit}^{2-}$ [c]	3·05
				Cit^{3-} [c]	4·896

[a] t = 18°C. [c] *Cit.* = citrate.

Table 45 (*cont.*)

Cation	Anion	p*K*	Cation	Anion	p*K*
Cd^{2+}	Cl^- [a]	1·00	Mg^{2+}	$Fe(CN)_6^{3-}$	2·788
	NO_3^- [a]	0·404		IO_3^-	0·72
	SO_4^{2-}	2·31		NO_3^-	0
	$S_2O_3^{2-}$	3·917		OH^-	2·58
	$(COO)_2^{2-}$	3·89	Na^+	IO_3^-	−0·48
	$CH_2(COO)_2^{2-}$	3·25		OH^-	−0·7
Ce^{3+}	SO_4^{2-}	3·371		$P_3O_9^{3-}$	1·17
Co^{2+}	SO_4^{2-}	2·47		$P_4O_{12}^{4-}$	2·
	$S_2O_3^{2-}$	2·05		SO_4^{2-}	0·72
	$(COO)_2^{2-}$	4·70		$S_2O_3^{2-}$	0·68
	$CH_2(COO)_2^{2-}$	3·72	Nd^{3+}	SO_4^{2-}	3·64
$Co(\mathit{en})_3^{3+}$ [d]	$P_3O_9^{3-}$	4·404	Ni^{2+}	$P_3O_9^{3-}$	3·220
	$P_4O_{12}^{4-}$	5·771		SO_4^-	2·40
	SO_4^{2-}	3·450		$S_2O_3^{2-}$	2·06
$Co(\mathit{pn})_3^{3+}$ [e]	$P_3O_9^{3-}$	3·646		$(COO)_2^{2-}$	5·30
	$P_4O_{12}^{4-}$	4·592		$CH_2(COO)_2^{2-}$	4·01
	SO_4^{2-}	2·757	Pb^{2+}	Br^-	1·2
$Co_2(\mathit{trien})_3^{6+}$ [b]	Cl^-	2·951		Cl^-	0·66
$Co(NH_3)_6S_2O_3^+$	$S_2O_3^{2-}$	2·0		I^-	1·46
Cu^{2+}	OH^-	6·47		NO_3^-	1·19
	$ClCH_2COO^-$	1·611		OH^-	7·82
	$C_6H_5CH_2COO^-$	1·975	Pr^{3+}	SO_4^{2-}	3·62
Er^{3+}	SO_4^{2-}	3·58	Pu^{4+}	Cl^-	−0·41
Fe^{3+}	Br^-	0·60		F^-	6·80
	CNS^-	2·983		NO_3^-	0·47
	Cl^-	1·48	Sm^{3+}	SO_4^{2-}	3·66
	OH^-	11·7	Sr^{2+}	$Fe(CN)_6^{3-}$	2·851
	OOH^-	9·312		IO_3^-	1·0
	$S_2O_3^{2-}$	3·253		NO_3^- [a]	0·82
Ga^{3+}	Cl^-	0		OH^-	0·96
	OH^-	11·4	Tl^+	CNS^-	0·796
Gd^{3+}	SO_4^{2-}	3·66		Cl^-	0·678
Hg^{2+}	Cl^-	6·74		F^-	0·1
Ho^{3+}	SO_4^{2-}	3·58		$Fe(CN)_6^{3-}$	3·22
K^+	BrO_3^-	−0·60		I^-	0·1
	ClO_3^- [a]	−0·15		NO_3^- [a]	0·28
	ClO_4^-	−0·48		OH^-	0·848
	$C(CoN)_6^{3-}$	1·2		SO_4^{2-}	1·37
	$Fe(CN)_6^{3-}$	1·2	Y^{3+}	SO_4^{2-}	3·47
	$Fe(CN)_6^{4-}$	2·26	Yb^{3+}	$(COO)_2^{2-}$	7·3
	IO_3^-	−0·3		SO_4^{2-}	3·58
	IO_4^-	0·24	Zn^{2+}	Br^-	0·60
	NO_3^-	−0·24		Cl^-	0·19
	ReO_4^{2-}	0·72		I^-	1·3
	SO_4^{2-}	0·96		OH^-	4·4
	$S_2O_3^{2-}$	0·92			
La^{3+}	$Fe(CN)_6^{3-}$	3·762			
	OH^-	3·3			
Li^+	NO_3^- [a]	0·640			
	OH^-	−0·08			

[a] t = 18°C.
[b] *trien* = triethylene tetramine.
[c] *Cit* = citrate.
[d] *en* = ethylene diamine.
[e] *pn* = propylene diamine.

46 AVERAGE THERMODYNAMIC DISSOCIATION CONSTANTS OF ION PAIRS IN AQUEOUS-NON-AQUEOUS MIXTURES AND NON-AQUEOUS SOLUTION AT 25°C (Concentrations in mole litre^{-1})

$\mathrm{La^{3+}Fe(CN)_6^{3-}}$			$\mathrm{Zn^{2+}CH_2(COO)_2^{2-}}$			$\mathrm{Ag^{+}CH_3COO^{-}}$			$\mathrm{Zn^{2+}SO_4^{2-}}$		
	Wt %	pK		Wt %	pK		Wt %	pK		Wt %	pK
Dioxan	9·67	4·117	Dioxan	10·30	4·143	Dioxan	15·0	1·02	Dioxan	17·26	2·919
	14·84	4·406		12·37	4·351		22·5	1·21		25·52	3·314
	18·08	4·592		17·11	4·504		31·7	0·72		30·83	3·588
	24·07	4·923		18·98	4·622		42·3	0·77	Acetone	10·95	2·654
Acetone	9·00	3·902		21·30	4·770	Acetone	21·1	1·06		13·67	2·818
	17·83	4·143	Acetone	11·83	4·196		26·1	1·28		26·33	3·198
	23·57	4·352		14·41	4·321		38·4	1·55	Glycol	27·11	2·600
	27·32	4·527		19·78	4·569		39·5	1·62		39·14	2·735
	30·49	4·666	Glycol	18·65	4·074	Glycol	39·3	0·86		52·20	2·959
Glycol	24·25	4·014		26·41	4·194		51·2	0·89	Ethanol	18·01	2·859
	32·26	4·157		33·17	4·309		63·1	0·96		24·99	3·116
	37·14	4·301		39·57	4·422	Ethanol	29·5	1·27			
	42·47	4·433	Ethanol	13·71	4·236		40·6	1·49			
Ethanol	14·11	4·139		20·50	4·401		52·2	1·82			
	18·89	4·298				Methanol	43·5	1·42			
							53·8	1·57			

TlCl	Wt %	pK
Glycol	20	1·0
	40	1·2
	60	1·3
	80	0·62
	100	−0·66
Ethanol	10	0·87
	30	1·08
	40	1·22
	51·25	1·30
	60	1·42

$\mathrm{PbCl_2}$	Wt %	pK
Glycol	20	1·64
	40	1·60
	60	1·92
	80	2·08
	100	2·58

$\mathrm{CuSO_4}$ in	pK
23·43% Dioxan	3·306
20·19% Acetone	3·043
35·03% Glycol	2·682
21·17% Ethanol	3·047

$\mathrm{AgNO_3}$ in	pK
Methanol	1·688
Ethanol	2·36
Acetonitrile	1·775
Benzonitrile	3·33
Pyridine	3·03
Ammonia*	2·314

* Temperature = −33°C

$\mathrm{MgSO_4}$ in	pK
10% Dioxan	2·512
20% Dioxan	2·906

47 SOLUBILITY PRODUCTS (EXPRESSED AS $\mathrm{p}K_{sp} = -\log_{10} K_{sp}$) IN AQUEOUS SOLUTION AT 25° C (Concentrations in mole litre^{-1}

	pK_{sp}		pK_{sp}		pK_{sp}
AgBr	12·303	$\mathrm{Ag_2SeO_4}$	7·248	$\mathrm{BaMnO_4}$	9·82
$\mathrm{AgBrO_3}$	4·263	$\mathrm{Ag_2WO_4}$[a]	9·3	$\mathrm{Ba(NO_3)_2}$	2·35
AgCN	13·80	$\mathrm{AgVO_3}$[a]	6·3	$\mathrm{Ba(OH)_2 8H_2O}$	2·30
AgCNO	6·64	AgOOCMe	2·71	$\mathrm{Ba_3(PO_4)_2}$	38·22
AgCNS	12·00	$\mathrm{AgOOC(CH_2)_3Me}$[b]	4·10	$\mathrm{BaSO_3}$	9·02
AgCNSe	14·16	$\mathrm{AgOOCC_6H_5}$	4·05	$\mathrm{BaSO_4}$	8·82
$\mathrm{Ag_2CO_3}$	11·09	$\mathrm{AgOOCC_6H_4OH}$[c]	4·857	$\mathrm{BaSeO_4}$	10·55
AgCl	9·752	$\mathrm{Al(OH)_3}$	32·3	$\alpha\mathrm{Be(OH)_2}$	25·80
$\mathrm{Ag_2CrO_4}$	10·96	$\mathrm{AlPO_4}$	18·24	$\mathrm{BiPO_4}$	22·89
$\mathrm{Ag_2Cr_2O_7}$	6·7	$\mathrm{Am(OH)_3}$	19·6	$\mathrm{Bi_2S_3}$	96·
$\mathrm{Ag_2HVO_4}$[a]	13·7	$\mathrm{Am(OH)_4}$	56·	$\mathrm{CaCO_3}$[e]	8·33
AgI	16·081	$\mathrm{Au(OH)_3}$	44·07	$\mathrm{CaCO_3}$[f]	8·16
$\mathrm{AgIO_3}$	7·51	$\mathrm{Ba(BrO_3)_2H_2O}$	5·24	$\mathrm{CaC_2O_4 \cdot H_2O}$	8·89
$\mathrm{Ag_2MoO_4}$	10·58	$\mathrm{BaCO_3}$	8·80	$\mathrm{CaCrO_4}$	3·15
$\mathrm{AgN_3}$	8·541	$\mathrm{BaC_2O_4 \cdot 2H_2O}$	7·82	$\mathrm{CaF_2}$	9·77
$\mathrm{AgNO_2}$	3·92	$\mathrm{BaCl_2 \cdot 2H_2O}$	−0·20	$\mathrm{CaHPO_4}$	5·7
$\mathrm{Ag_3PO_4}$	19·89	$\mathrm{BaF_2}$	4·62	$\mathrm{Ca(IO_3)_2 \cdot 6H_2O}$	5·762
$\alpha\mathrm{Ag_2S}$	49·15	$\mathrm{Ba(HSO_4)_2}$	−0·43	$\mathrm{Ca(OH)_2}$	5·89
$\mathrm{Ag_2SO_4}$	4·907	$\mathrm{Ba(IO_3)_2H_2O}$	8·903	$\mathrm{CaSO_4 \cdot 2H_2O}$	4·62

[a] 20°C. [b] 18·6°C. [c] 15°C. [d] 18°C. [e] Calcite. [f] Aragonite. [g] Sphalerite. [h] Wurtzite.

Table 47 (cont.)

	pK_{sp}		pK_{sp}		pK_{sp}
$\mathrm{CaWO_4}$	12·10	$\mathrm{Hg_2(OOCMe)_2}$	9·44	$\mathrm{Pr_2(C_2O_4)_3 10H_2O}$	27·32
$\mathrm{CaC_4H_4O_6 \cdot 2H_2O}$	6·11	$\mathrm{Hg_2C_4H_4O_6}$	10·	$\mathrm{Pr(OH)_3}$	19·57
$\mathrm{CdCO_3}$	11·28	$\mathrm{Ho(OH)_3}$	22·3	$\mathrm{Pt(OH)_2}$	35 0
$\mathrm{Cd(OH)_2}$	13·70	$\mathrm{In(OH)_3}$	3·7	PtS	72·1
CdS	28·15	$\mathrm{KClO_4}$	2·05	$\mathrm{Pu(OH)_3}$	19·7
CdTe	42·	$\mathrm{KMnO_4}$[d]	0·85	$\mathrm{Pu(OH)_4}$	52·
$\mathrm{Ce_2(C_2O_4)_3 \cdot 10H_2O}$	28·58	$\mathrm{K_2PdCl_6}$	5·22	$\mathrm{RaCl_2 \cdot 2H_2O}$	0·4
$\mathrm{Ce(OH)_3}$	19·82	$\mathrm{K_2PtCl_6}$	5·8	$\mathrm{Ra(NO_3)_2}$	2·20
$\mathrm{Ce_2S_3}$	10·22	$\mathrm{La_2(C_2O_4)_3 \cdot 10H_2O}$	27·7	$\mathrm{RaSO_4}$	10·4
$\mathrm{Ce_2(C_4H_4O_6)_3 \cdot 9H_2O}$	19·01	$\mathrm{La_2(IO_3)_3 \cdot 3H_2O}$	9·23	$\mathrm{RbClO_4}$	2·42
$\mathrm{Cm(OH)_3}$	20·72	$\mathrm{La(OH)_3}$	19·0	$\mathrm{RbIO_3}$	2·331
$\mathrm{CoCO_3}$	12·1	$\mathrm{La_2S_3}$	12·7	$\mathrm{ScF_3}$	19·5
$\mathrm{Co_2O_3}$	124·	$\mathrm{La_2(C_4H_4O_6)_3 \cdot 3H_2O}$	18·66	$\mathrm{Sc(OH)_3}$	27·
$\mathrm{Co(OH)_2}$	15·60	$\mathrm{Li_2CO_3}$	0·51	$\mathrm{Sm(OH)_3}$	21·17
$\mathrm{Co(OH)_3}$	43·	$\mathrm{Lu(OH)_3}$	23·60	$\mathrm{Sn(OH)_2}$	25·81
$\alpha\mathrm{CoS}$	21·3	$\mathrm{MgCO_3}$	8·10	$\mathrm{Sn(OH)_4}$	57·
$\beta\mathrm{CoS}$	26·72	$\mathrm{MgC_2O_4}$	4·07	SnS	26·0
$\mathrm{Cr(OH)_2}$	17·0	$\mathrm{Mg_3(AsO_4)_2}$	35·	$\mathrm{Sr_3(AsO_4)_2}$	48·7
$\mathrm{Cr(OH)_3}$	30·17	$\mathrm{MgF_2}$	7·10	$\mathrm{SrCO_3}$	9·15
$\mathrm{CrPO_4}$ green	22·62	$\mathrm{MgNH_4PO_4}$	12·60	$\mathrm{SrC_2O_4H_2O}$	7·251
$\mathrm{CrPO_4}$ violet	17·0	$\mathrm{Mg(NH_4)_2(SO_4)_2}$	12·60	$\mathrm{SrCrO_4}$	4·44
$\mathrm{CsClO_4}$	2·49	$\mathrm{Mg(OH)_2}$	11·05	$\mathrm{SrF_2}$	9·10
CuBr	8·23	$\mathrm{MnCO_3}$	10·05	$\mathrm{Sr(HCO_3)_2}$	5·737
$\mathrm{CuCO_3}$	9·60	$\mathrm{Mn(OH)_2}$	12·7	$\mathrm{SrHPO_4}$	3·7
$\mathrm{CuC_2O_4}$	7·54	$\mathrm{Mn(OH)_3}$	36·	$\mathrm{Sr(OH)_2 \cdot 8H_2O}$	3·49
CuCNS	13·40	$\mathrm{Mn_3(PO_4)_2}$	22·	$\mathrm{Sr_3(PO_4)_2}$	31·0
CuCl	6·49	MnS	11·0	$\mathrm{SrSO_4}$	6·12
$\mathrm{Cu(IO_3)_2}$	6·89	$\mathrm{(NH_4)_2PtCl_6}$	5·04	$\mathrm{SrWO_4}$	9·77
CuI	11·96	$\mathrm{NaHCO_3}$	2·92	$\mathrm{Tb(OH)_3}$	21·70
$\mathrm{Cu_2S}$	48·0	$\mathrm{Nd(OH)_3}$	20·72	$\mathrm{Te(OH)_4}$[d]	54·2
CuS	35·10	$\mathrm{NiCO_3}$	6·87	$\mathrm{ThF_4}$	11·2
CuSe	49·	$\mathrm{Ni(OH)_2}$	17·19	$\mathrm{Th(IO_3)_4}$	14·62
$\mathrm{Dy(OH)_3}$	21·85	$\alpha\mathrm{NiS}$	20·5	$\mathrm{Th(OH)_4}$	39·0
$\mathrm{Er(OH)_3}$	22·89	$\beta\mathrm{NiS}$	26·	$\mathrm{Ti(OH)_3}$	40·
$\mathrm{Eu(OH)_3}$	21·47	$\gamma\mathrm{NiS}$	27·7	TlBr	5·44
$\mathrm{FeC_2O_4}$	6·68	$\mathrm{NpF_3}$	11·	$\mathrm{TlBrO_3}$	3·41
$\mathrm{Fe(OH)_2}$	14·74	$\mathrm{NpF_4}$	12·3	$\mathrm{TlBrO_4}$	3·93
$\mathrm{Fe(OH)_3}$	37·22	$\mathrm{PbBr_2}$	5·24	TlCl	3·72
$\mathrm{FeCO_3}$	10·67	$\mathrm{Pb(BrO_3)_2}$	3·54	TlCNS	3·24
$\mathrm{FePO_4}$	22·89	$\mathrm{PbCO_3}$	12·82	TlI	7·05
$\alpha\mathrm{FeS}$	17·3	$\mathrm{PbC_2O_4}$	11·08	$\mathrm{TlN_3}$	3·66
$\mathrm{Fe(SH)_2}$	10·55	$\mathrm{PbCl_2}$	4·80	TlOH	0·14
FeSe	26·	$\mathrm{PbCrO_4}$	15·7	$\mathrm{Tl(OH)_3}$	43·82
$\mathrm{Ga(OH)_3}$	36·3	$\mathrm{PbF_2}$	7·57	$\mathrm{TlIO_3}$	5·5
$\mathrm{Gd(OH)_3}$	21·68	$\mathrm{PbHPO_3}$	6·24	$\mathrm{Tl_2S}$	19·2
$\mathrm{Hg_2Br_2}$	21·89	$\mathrm{PbHPO_4}$	11·06	$\mathrm{Tl_2Se}$	35·
$\mathrm{Hg_2CO_3}$	16·05	$\mathrm{PbI_2}$	8·02	$\mathrm{Tl_2Te}$	33·5
$\mathrm{Hg_2C_2O_4}$	13·	$\mathrm{Pb(IO_3)_2}$	12·49	$\mathrm{Tm(OH)_3}$	23·48
$\mathrm{Hg_2(CN)_2}$	39·3	$\mathrm{PbMoO_4}$	5·40	$\mathrm{UF_3}$	12·
$\mathrm{Hg_2(CNS)_2}$	19·52	$\mathrm{Pb(N_3)_2}$	12·	$\mathrm{UF_4}$	13·43
$\mathrm{Hg_2Cl_2}$	17·96	$\mathrm{Pb(OH)_2}$	14·38	$\mathrm{U(OH)_3}$	19·0
$\mathrm{Hg_2CrO_4}$	8·7	$\mathrm{Pb_3(PO_4)_2}$	54·	$\mathrm{U(OH)_4}$	45·
$\mathrm{Hg_2I_2}$	28·35	$\mathrm{Pb_2P6O_4}$	50·28	$\mathrm{Y(OH)_3}$	22·09
$\mathrm{Hg_2(IO_3)_2}$	17·89	PbS	29·1	$\mathrm{Yb(OH)_3}$	23·54
$\mathrm{Hg(IO_3)_2}$	12·52	$\mathrm{PbSO_4}$	7·89	$\mathrm{ZnCO_3}$	9·7
$\mathrm{Hg_2HPO_4}$	14·52	$\mathrm{PbS_2O_3}$	3·82	$\mathrm{Zn(OH)_2}$	16·35
$\mathrm{Hg(OH)_2}$	21·92	PbSe	38·	$\mathrm{Zn_3(PO_4)_2}$	32·04
$\mathrm{Hg_2S}$	45·	$\mathrm{PbSeO_4}$	8·	ZnS[g]	25·15
HgS	51·52	PbTe	48·	ZnS[h]	22·80
$\mathrm{Hg_2SO_4}$	6·0	$\mathrm{Pd(OH)_3}$	31·	ZnSe	31·
$\mathrm{HgWO_4}$[d]	16·96	$\mathrm{Pm(OH)_3}$	21·0	$\mathrm{Zr(OH)_4}$	57·2

[a] 20°C. [b] 18·6°C. [c] 15°C. [d] 18°C. [e] Calcite. [f] Aragonite. [g] Sphalerite. [h] Wurtzite.

48 SOLUBILITY PRODUCTS (EXPRESSED AS p$K_{sp} = -\log_{10} K_{sp}$) IN NON-AQUEOUS MIXTURES AT 25°C (Concentrations in mole litre^{-1})

Second component	Wt. %	$Ca(IO_3)_2$	$Ba(IO_3)_2$	$La(IO_3)_3$
Methanol	0·00	6·100	8·809	11·186
	4·72	6·501	9·252	11·867
	9·53	6·900	9·686	12·469
	14·43	7·280	10·136	13·109
Ethanol	3·82	6·463	9·232	11·821
	7·67	6·818	9·644	12·387
	11·59	7·170	10·058	12·999
Acetone	4·09	6·446	9·195	11·805
	8·25	6·787	9·566	12·356
	12·46	7·145	9·959	13·065
n-Propanol	4·16	6·482	9·238	11·833
	8·40	6·862	9·664	12·441
	12·71	7·243	10·096	13·039
Ethyl acetate	3·8	6·378	9·108	11·673
	6·1	6·541	9·284	11·936
Dioxan	2·2	6·239	8·972	11·416
	4·7	6·388	9·145	11·663
	9·4	6·694	9·504	12·175
	10·0		9·500	
Glycol	5·62	6·216	8·966	11·452
	11·24	6·321	9·113	11·641
	16·85	6·420	9·253	11·847
Glycerol	6·31	6·118	8·859	11·316
	12·44	6·147	8·914	11·387
	18·43	6·161	8·958	11·456

$AgBrO_3$ AT 25°C

Second component	Wt. % Second Component						
	10%	20%	30%	40%	50%	60%	70%
Methanol	4·592	4·912	5·220	5·541	5·871	6·216	
Ethanol	4·592	4·900	5·184	5·483	5·805		
n-Propanol	4·553	4·803	5·046	5·326	5·671		
Acetone	4·534	4·812	5·121	5·459			
Glycol	4·361	4·456	4·549	4·643	4·743		4·981
Glycerol	4·300	4·338	4·382	4·425	4·476	4·539	4·620
Dioxan	4·496	4·739					
	5%	10%	15%				
Mannitol	4·251	4·238	4·227				
	11·12%	22·90%	31·16%	39·77%			
i-Propanol	4·631	4·966	5·185	5·442			

Table 48 (cont.)

AgI AT 25°C IN ACETONE

	Mole % Non-aqueous Component			
	19·73%	46·4%	84·55%	100%
Acetone	16·37	17·17	19·71	21·96

pK_{sp} IN ANHYDROUS SOLVENTS

Solvent	AgCl	AgBr	AgI	AgCNS	TlCl
Methanol	13·05	15·24	18·22	13·74	4·36
Ethanol	13·92	16·00	18·95	14·33	4·89

49 pK_{sp} for SILVER HALIDES IN AQUEOUS SOLUTION

	5°C	15°C	25°C	35°C	45°C
AgCl	10·595	10·154	9·752	9·382	9·044
AgBr	13·386	12·820	12·303	11·838	11·392
AgI	17·498	16·760	16·081	15·456	14·879

50 THE EFFECT OF PRESSURE UPON THE EQUILIBRIUM CONSTANTS OF SOME IONIC REACTIONS IN AQUEOUS SOLUTION

Reaction	Temp.	Values of $K_{(p)}/K_{(p=1)}$				
		200[a]	400[a]	600[a]	800[a]	1000[a]
$H_2O \rightleftharpoons H^+ + OH^-$	5°C	1·25	1·54	1·9	2·3	2·8
	15°C	1·225	1·490	1·80	2·16	2·59
	25°C	1·202	1·435	1·703	2·009	2·358
	35°C	1·180	1·384	1·61	1·87	2·15
	45°C	1·16	1·35	1·5	1·8	2·0
$CH_3COOH \rightleftharpoons H^+ + CH_3COO^-$	25°C	1·075	1·154	1·235	1·32	1·41
$H_2CO_3 \rightleftharpoons H^+ + HCO_3^-$	25°C	1·26	1·60	2·02	2·6	3·2
$HCO_3^- \rightleftharpoons H^+ + CO_3^{2-}$	25°C	1·241	1·522	1·85	2·22	2·65
Anhydrite $\rightleftharpoons Ca^{2+} + SO_4^{2-}$	25°C	1·47	2·12	3·00	4·20	5·80
Calcite $\rightleftharpoons Ca^{2+} + CO_3^{2-}$	25°C	1·58	2·44	3·69	5·52	8·10
Aragonite $\rightleftharpoons Ca^{2+} + CO_3^{2-}$	25°C	1·54	2·32	3·44	5·01	7·18
Magnesite $\rightleftharpoons Mg^{2+} + CO_3^{2-}$	25°C	1·50	2·21	3·18	4·49	6·24
Witherite $\rightleftharpoons Ba^{2+} + CO_3^{2-}$	25°C	1·61	2·53	3·88	5·84	8·60

[a] Total pressure in bars.

51 APPARENT MOLAL VOLUMES IN AQUEOUS SOLUTION

Constants for the equation $\phi_v = \phi_v^\circ + S_v c^{1/2}$ cm³ mole⁻¹
c = concentration in mole litre⁻¹.

Salt	t°C	ϕ_v°	S_v	Salt	t°C	ϕ_v°	S_v
$AgNO_3$	25·00	28·01	2·61	LiCl	70·19	16·14	1·663
$BaCl_2$	25·00	23·60	4·83		100·0	15·95	1·606
$CaCl_2$	25·00	18·25	6·00	$LiClO_4$	20·00	42·5	1·0
$CdAc_2$	25·00	71·35	24·25	LiI	0·00	32·50	1·425
$CdBr_2$	25·00	33·3	18·9		25·00	35·50	0·841
$CdCl_2$	25·00	23·24	8·82		50·04	36·81	0·569
CsBr	0·00	41·95	3·046		70·19	36·85	0·708
	25·00	46·19	1·901	$LiNO_3$	20·00	28·1	1·1
	50·04	47·81	1·632	LiOH	25·00	−6·0	3·00
	70·19	48·24	1·646	$MgCl_2$	25·00	15·3	4·26
CsCl	0·00	35·23	3·293	NH_4Br	20·00	42·6	1·2
	25·00	39·15	2·172	NH_4Cl	25·00	35·98	1·45
	50·04	40·39	1·958	NH_4ClO_4	20·00	61·7	1·0
	70·19	40·45	2·053	NH_4I	20·00	54·4	0·7
CsI	0·00	52·74	2·885	NH_4NO_3	25·00	47·56	0·97
	25·00	57·74	1·579	NaAc	25·00	40·1	1·9
	50·04	60·32	1·084	NaBr	0·00	18·86	2·976
	70·19	61·06	1·160		25·00	23·51	1·760
HCl	25·00	18·07	0·95		50·04	25·34	1·398
KBr	0·00	29·38	3·219		70·19	25·80	1·377
	25·00	33·73	1·939	Na_2CO_3	25·00	−6·74	11·30
	50·04	35·32	1·640	NaCl	0·00	12·36	3·240
$KBrO_3$	20·00	43·3	2·9		25·00	16·40	2·153
KCNS	20·00	48·8	1·7		50·04	17·96	1·804
KCl	0·00	23·00	3·291	$NaClO_3$	20·00	34·8	2·0
	25·00	26·52	2·327	$NaClO_4$	20·00	41·6	2·6
	50·04	27·66	2·087	NaF	20·00	−2·7	1·8
	70·19	27·95	1·982	NaI	0·00	29·34	2·886
	100·0	26·49	2·574		25·00	35·10	1·346
$KClO_3$	20·0	45·2	2·3		50·04	37·68	0·826
K_2CrO_4	25·00	37·1	11·7	NaOH	25·00	−6·7	4·18
KF	25·00	6·60	3·35	Na_2SO_4	25·00	11·52	12·16
$KHCO_3$	25·00	32·7	2·6	RbBr	0·00	34·61	3·112
KI	0·00	40·05	3·133		25·00	38·71	2·038
	25·00	45·36	1·556		50·04	40·28	1·757
	50·04	47·58	1·168	RbCl	0·00	28·11	3·287
KIO_3	20·0	34·3	2·7		25·00	31·87	2·219
$KMnO_4$	25·00	51·7			50·04	32·95	2·047
KNO_3	25·00	38·18	2·30	RbI	0·00	45·15	3·158
KOH	25·00	2·9	4·35		25·00	50·31	1·607
K_2SO_4	25·00	32·28	18·11		50·04	52·75	1·224
$LaCl_3$	25·00	16·0	11·87	$RbNO_3$	20·00	42·3	2·7
LiBr	0·00	21·94	1·673	$SrCl_2$	25·00	17·9	9·90
	25·00	24·08	1·159	$TlNO_3$	20·00	40·2	2·2
	50·04	24·37	1·145	Me_4NCl	20·00	107·1	0
	70·19	23·88	1·312	Me_4NI	20·00	125·0	2
LiCl	0·00	15·30	1·990	Et_4NCl	20·00	168·5	−5
	25·00	17·00	1·488	Et_4NI	20·00	186·5	−3
	50·04	16·96	1·446				

52 APPARENT MOLAL EXPANSIBILITY [$\phi(E)$] AND INTEGRAL COEFFICIENTS OF EXPANSION (α) IN AQUEOUS SOLUTION AT 25°C AND 1 atm.

Constants for the equation:

$\phi(E) = \phi^\circ(E) + S_E c^{1/2}$ cm³ deg⁻¹ mole⁻¹; $\alpha = 2{\cdot}55 \times 10^{-4} + Ac + Bc^{3/2}$ deg⁻¹.

Salt	$\phi^\circ(E) \times 10^2$	$S_E \times 10^2$	$A \times 10^4$	$B \times 10^4$
HCl	3·4	−0·02	0·29	−0·004
KCl	8·50	−2·20	0·78	−0·226
LiCl	2·5	−0·65	0·21	−0·069
LiOH	4·5	−1·8	0·47	−0·19
NaCl	9·30	−2·10	0·89	−0·216
NaOH	11·7	−3·5	1·19	−0·36
Na_2SO_4	22·19	−9·33	2·19	−0·966

53 INTEGRAL COEFFICIENT OF EXPANSION (α) AND APPARENT MOLAL THERMAL EXPANSIBILITY [$\phi(E)$] IN AQUEOUS SOLUTION AT 1 atm.

α in deg⁻¹; $\phi(E)$ in cm³ deg⁻¹ mole⁻¹

m	25°C		35°C		45°C		55°C	
	$\alpha \times 10^4$	$\phi(E)$	$\alpha \times 10^4$	$\phi(E)$	$\alpha \times 10^4$	$\phi(E)$	$\alpha \times 10^4$	$\phi(E)$
				$BaCl_2$				
0·01005	2·5731	0·107	3·4571	0·074	4·2202	0·014	4·9052	−0·011
0·06028	2·6415	0·1374	3·4894	0·0740	4·2301	0·0290	4·8922	−0·0079
0·10054	2·6922	0·1357	3·5191	0·0780	4·2395	0·0316	4·8858	−0·0058
0·25239	2·8790	0·1334	3·6211	0·0781	4·2788	0·0359	4·8724	+0·0010
0·50852	3·1578	0·1259	3·7784	0·0757	4·3440	0·0377	4·8598	+0·0057
1·03382	3·6002	0·1113	4·0418	0·0699	4·4543	0·0370	4·8422	+0·0092
				$LaCl_3$				
0·06464	2·6114	0·0797	3·4510	0·0070	4·1815	−0·0521	4·8358	−0·0997
0·09045	2·6335	0·0831	3·4523	0·0084	4·1692	−0·0482	4·8116	−0·0954
0·16154	2·6858	0·0817	3·4604	0·0133	4·1385	−0·0422	4·7498	−0·0878
0·36453	2·8241	0·0779	3·4836	0·0171	4·0643	−0·0333	4·6001	−0·0742
0·70812	3·0066	0·0704	3·5034	0·0166	3·9610	−0·0264	4·3873	−0·0628
1·04320	3·1221	0·0624	3·5032	0·0149	3·8680	−0·0230	4·2167	−0·0552
				KCl				
0·00	2·5635		3·4507		4·2194		4·9050	
0·06022	2·6028	0·0737	3·4705	0·0432	4·2263	0·0235	4·9003	0·0066
0·10053	2·6275	0·0713	3·4847	0·0454	4·2291	0·0217	4·8985	0·0076
1·0308	3·1056	0·0618	3·7506	0·0405	4·3301	0·0237	4·8596	0·0101
3·2731	3·6642	0·0454	4·0365	0·0311	4·3885	0·0195	4·7238	0·0098

KCl

m	65°C		75°C	
	$\alpha \times 10^4$	$\phi(E)$	$\alpha \times 10^4$	$\phi(E)$
0·00	5·5333		6·1235	
0·10053	5·5115	−0·0040	6·0844	−0·0235
1·0308	5·3508	−0·0021	5·8225	−0·0127
3·273	5·0436	+0·0012	5·3579	−0·0065

54 APPARENT MOLAL COMPRESSIBILITY IN AQUEOUS SOLUTION AT 25°C

$\phi_k = \phi_k^\circ + S_k\sqrt{c}$ cm³ bar⁻¹ mole⁻¹

Salt	$10^4 \times -\phi_k^\circ$	$10^4 \times S_k$
$AgNO_3$	38·2	6·9
$BaCl_2$	115	26·8
$BeSO_4$	93	
$CaCl_2$ [a]	87	26·0
$CdSO_4$	127	
$CeCl_3$	176	
CsBr	32·7	9·3
CsCl	41·3	11·5
CsI	22·1	7·5
$CsNO_3$	31·4	9·7
Cs_2SO_4	119	
$CuSO_4$	132	
HCl	8·3	3·0
KAc [b]	47	
KBr	39·6	8·9
$KBrO_3$	49·0	10·6
KCNS	26·9	4·8
KCl	45·2	12·4
$KClO_3$	37·2	9·0
K_2CrO_4	139	
KF	75·4	15·4
$KHCO_3$	35	
KI	29·0	6·5
KIO_3	78·0	16·2
KNO_3	38·2	9·9
KOH	81	
K_2SO_4	139	
LiBr	35·6	7·1
LiCl	42·0	9·1
$LiClO_4$	25·2	3·3
LiI	25·1	5·1
$LiNO_3$	34·0	6·0
LiOH	77·9	17·0
Li_2SO_4	146	
$MgSO_4$	153	35·2
NH_4Br	12·8	3·4
NH_4Cl	22·0	6·6
NH_4ClO_4	3·1	−1·8
NH_4I	2·7	1·0
NH_4NO_3	11·7	2·4
$(NH_4)_2SO_4$	91	
NaBr	46·8	8·0
Na_2CO_3	171	48·8
NaCl	51·6	11 4
$NaClO_3$	45·7	7·6
$NaClO_4$	36 8	4·8
NaF	82·2	16·2
NaI	35·7	4·9
$NaNO_3$	45·6	9·3
NaOH	89·0	20·9
NaPic [c]	100	88
Na_2SO_4	154	
RbBr	36·7	9·0
RbCl	45·3	11·2
RbI	25·9	6·5
$RbNO_3$	35·1	9·6
$TlNO_3$	35·1	5·4
$ZnSO_4$	140	
Me_4NCl	17·2	6·5
Me_4NI	−2·1	9·0
Et_4NCl	20·1	4·8
Et_4NI	0·2	10·0

[a] At 30°C and 100 bars [b] Ac = Acetate [c] Pic = Picrate

55 APPARENT MOLAL VOLUMES IN AQUEOUS SOLUTION AT 25°C

Constants for the equation (valid to $c_{max.}$):

$$\phi_v = \phi_v^\circ + S_v c^{1/2} + b c^{3/2} \text{ cm}^3 \text{ mole}^{-1}$$

Salt	ϕ_v°	S_v	b	$c_{max.}$
CsBr	46·20	1·900	0	4·18
CsCl	39·08	2·192	0	7·5
CsI	57·82	1·540	0	2·9
KBr	33·62	2·006	0	4·6
KCl	26·66	2·190	0·0150	3·8
KI	45·23	1·620	0	5·6
LiBr	23·97	1·375	−0·0595	13·2
LiCl	17·06	1·456	−0·0271	13·8
LiI	35·53	0·931	−0·0725	8·4
NaBr	23·50	1·765	0	5·5
NaCl	16·50	2·034	0·0120	5·3
NaI	35·14	1·330	0	6·7
RbBr	38·70	2·030	0	5·17
RbCl	31·94	2·127	0·0133	6·0
RbI	50·40	1·650	0	2·78

(*By courtesy of National Bureau of Standards; Symposium,* Electrochemical Constants 1951)

56 CONDUCTIVITY OF MOLTEN SALT MIXTURES

Constants for the equation $\kappa = A \exp(-E/RT)$ ohm⁻¹ cm⁻¹ (E in kcal mole⁻¹). κ = specific conductivity. E = energy of activation. Temperature range: 10°C above liquidus to that shown in column 2. x_1 = mole % of component 1.

Components		x_1	A	E
1	2			
$NaNO_2$	$NaNO_3$	100·0	13·2	2·60
		92·5	13·2	2·64
	(450)	85·0	12·6	2·63
		70·0	12·0	2·62
		50·0	11·2	2·62
		25·0	11·7	2·75
		20·0	12·4	2·86
		0·0	13·4	3·12
CdI_2	$CdCl_2$	100·0	25·3	6·34
		75·0	12·4	4·77
	(700)	50·0	9·28	3·82
		25·0	7·36	2·98
		0·0	6·92	2·20
KBr	$BaBr_2$	100·0	5·99	2·64
		79·5	8·10	3·74
	(850)	75·7	8·61	3·92
		66·7	9·06	4·20
		60·0	10·13	4·78
		48·0	12·5	5·12
		35·0	15·9	5·75
		25·0	16·3	5·84
		15·0	23·4	6·75
LiCl	$CdCl_2$	100·0	12·6	1·34
		75·0	11·3	1·85
	(750)	50·0	10·3	2·16
		25·0	9·09	2·27
		0·0	6·92	2·20
KCl	NaI	100·0	9·14	3·01
		85·0	9·53	3·14
	(800)	66·7	10·7	3·39
		50·0	9·50	3·15
		33·3	10·2	3·12
		15·0	9·03	2·72
		0·0	7·35	2·13
KI	NaCl	100·0	5·81	2·85
	(800)	85·0	7·83	3·21
		70·0	8·94	3·28
		50·0	9·62	3·15
		30·0	11·0	3·07
		15·0	13·2	3·11
		0·0	7·45	1·58
CdI_2	KI	100·0	25·3	6·34
	(700)	80·0	5·19	3·39
		58·0	5·10	3·18
		52·5	7·26	3·56
		45·0	6·64	3·53
	(800)	33·3	8·02	3·80
		25·0	38·5	6·38
		20·0	7·00	3·60
		10·0	8·59	3·80
		5·0	7·81	3·53
		0·0	5·81	2·85
KNO_3	KBr	100·0	8·55	3·15
	(600)	85·0	7·59	3·01
		66·7	7·07	2·93
		50·0	7·56	3·05
	(800)	33·3	6·47	2·78
		15·0	6·47	2·78
		0·0	7·63	3·11
NaCl	KBr	50·0	3·08	10·0
KCl	NaBr (800)	50·0	3·16	10·8

57 RATIONAL ACTIVITY COEFFICIENTS (f) FOR SALTS IN MOLTEN SALT MIXTURES

x is the mole fraction of the component mentioned first

	Temp.	AgBr in AgBr + KBr				AgBr in AgBr + LiBr			
x		0·800	0·6005	0·4502	0·3538	0·5937	0·4086	0·2548	0·1100
f	500°C	0·994	0·868	0·745	0·680	1·211	1·477	2·040	2·651
	550°C	0·992	0·875	0·758	0·684	1·199	1·432	1·950	2·457
	600°C	0·989	0·880	0·770	0·688	1·194	1·408	1·887	2·303

	Temp.	AgBr in AgBr + $PbBr_2$							
x		0·80	0·70	0·60	0·50	0·40	0·30	0·20	0·10
f	450°C	1·00	0·99	0·99	0·99	1·00	1·04	1·06	1·06
	500°C	1·00	1·00	1·00	1·00	1·01	1·05	1·06	1·07
	550°C	0·99	1·00	1·01	1·00	1·02	1·06	1·06	1·08

	Temp.	AgBr in AgBr + NaBr			AgCl in AgCl + LiCl					
x		0·7486	0·6045	0·5130	0·804	0·690	0·573	0·469	0·252	0·176
f	550°C	1·071	1·112	1·160	1·099	1·147	1·294	1·471	2·097	2·881
	600°C	1·063	1·101	1·142	1·083	1·124	1·242	1·384	1·931	2·592

	Temp.	AgBr in AgBr + RbBr				AgCl in AgCl + $PbCl_2$					
x		0·747	0·596	0·467	0·352	0·800	0·600	0·450	0·300	0·200	0·100
f	500°C	0·918	0·754	0·614	0·487	1·00	0·98	0·98	0·98	0·98	1·02
	600°C	0·921	0·782	0·655	0·535	1·00	0·98	0·98	0·98	0·99	1·03

	Temp.	$MgCl_2$ in $MgCl_2$ + KCl					$MgCl_2$ in $MgCl_2$ + NaCl				
x		0·900	0·833	0·667	0·500	0·333	0·900	0·833	0·667	0·500	0·333
f	650°C	0·84	0·63	0·41	0·090	0·026	0·99	0·82	0·65	0·27	0·13
	700°C	0·88	0·70	0·50	0·126	0·040	1·00	0·90	0·79	0·36	0·18
	750°C	0·91	0·77	0·59	0·174	0·059	1·03	0·97	0·93	0·47	0·24
	800°C	0·95	0·85	0·70	0·234	0·084	1·05	1·05	1·09	0·59	0·31

	Temp.	$PbCl_2$ in $PbCl_2$ + KCl					$PbCl_2$ in $PbCl_2$ + $ZnCl_2$			
x		0·95	0·90	0·70	0·60	0·885	0·688	0·595	0·490	0·301
f	500°C	0·914	0·857	0·517	0·258	0·930	0·865	0·770	0·675	0·575
	600°C	0·947	0·898	0·640	0·346	0·945	0·840	0·750	0·685	0·515

	Temp.	$PbBr_2$ in $PbBr_2$ + $ZnBr_2$								
x		0·902	0·794	0·704	0·604	0·486	0·392	0·288	0·210	0·200
f	400°C	1·02	1·03	1·05	1·06	1·08	1·16	1·30	1·47	1·49
	450°C	1·01	1·02	1·02	1·03	1·06	1·11	1·20	1·29	1·30
	500°C	1·01	1·00	1·01	1·00	1·03	1·07	1·11	1·14	1·15

	Temp.	$PbBr_2$ in $PbBr_2$ + $PbCl_2$				Temp.	SiO_2 in SiO_2 + CaO[a]				
x		0·80	0·60	0·50	0·45		0·583	0·558	0·533	0·508	0·483
f	450°C	0·873	0·766	0·682	0·588	1500°C	1·51	1·38			
	500°C	0·856	0·737	0·667	0·581	1525°C	1·42	0·29	1·22		
	550°C	0·845	0·713	0·652	0·576	1550°C	1·35	1·22	1·14	1·17	0·83
						1575°C	1·28	1·15	1·06	1·08	0·76
						1600°C	1·22	1·08	0·99	1·00	0·69

[a] Standard state is β-cristobalite at the given temperature.

58 E.M.F. OF CELLS CONTAINING MOLTEN SALTS

(a) VALUES CONSISTENT WITH THE ACTIVITY COEFFICIENTS OF TABLE 57

$\mathrm{Ag}(s)\mid\mathrm{AgBr}(l)\mid\mathrm{Br_2}(g)$		$\mathrm{Pb}(l)\mid\mathrm{PbBr_2}(l)\mid\mathrm{Br_2}(g)$	
Temp.		Temp.	
450°C	$E = 0·8010$ V	400°C	$E = 1·0928$ V
500°C	$E = 0·7865$ V	450°C	$E = 1·0624$ V
550°C	$E = 0·7720$ V	500°C	$E = 1·0321$ V
600°C	$E = 0·7577$ V	550°C	$E = 1·0017$ V
$\mathrm{Ag}(s)\mid\mathrm{AgCl}(l)\mid\mathrm{Cl_2}(g)$		$\mathrm{Pb}(l)\mid\mathrm{PbCl_2}(l)\mid\mathrm{Cl_2}(g)$	
Temp.		Temp.	
500°C	$E = 0·9001$ V	500°C	$E = 1·2730$ V
600°C	$E = 0·8709$ V	600°C	$E = 1·2105$ V

(b) SOME OTHER VALUES

$\mathrm{Pb}\mid\mathrm{PbCl_2}\mid\mathrm{Cl_2}$	(500 − 800°C)	$E = 1·2467 - 6·5 \times 10^{-4}(t - 550)$ V
$\mathrm{Cd}\mid\mathrm{CdCl_2}\mid\mathrm{Cl_2}$	(600 − 780°C)	$E = 1·3421 - 6·3 \times 10^{-4}(t - 599)$ V
$\mathrm{Mg}\mid\mathrm{MgCl_2}\mid\mathrm{Cl_2}$	(700 − 800°C)	$E = 2·5112 - 6·7 \times 10^{-4}(t - 700)$ V
$\mathrm{Zn}\mid\mathrm{ZnCl_2}\mid\mathrm{Cl_2}$	(417 − 700°)	$E = 1·6050 - 4·6 \times 10^{-4}(t - 427) - 8·9 \times 10^{-7}(t - 427)^2$ V
$\mathrm{Mg}\mid\mathrm{MgCl_2}\mid\mathrm{KCl + NaCl}\mid\mathrm{CdCl_2}\mid\mathrm{Cd}$	(680 − 750°C)	$E = 0·964 + 1·07 \times 10^{-3}(t - 720)$ V
$\mathrm{Mg}\mid\mathrm{MgCl_2}\mid\mathrm{PbCl_2}\mid\mathrm{Pb}$	(660 − 760°C)	$E = 1·078 + 1·08 \times 10^{-3}(t - 720)$ V
$\mathrm{Mg}\mid\mathrm{MgCl_2}\mid\mathrm{TlCl}\mid\mathrm{Tl}$	(660 − 750°C)	$E = 0·530 - 4·3 \times 10^{-4}(t - 720)$ V
$\mathrm{Mg}\mid\mathrm{MgCl_2}\mid\mathrm{ZnCl_2}\mid\mathrm{Zn}$	(720 − 750°C)	$E = 0·759 - 7·3 \times 10^{-4}(t - 720)$ V
$\mathrm{Pb}\mid\mathrm{PbCl_2}\mid\mathrm{TlCl}\mid\mathrm{Tl}$	(500 − 600°C)	$E = 0·365 + 3·9 \times 10^{-4}(t - 500)$ V
$\mathrm{Sn}\mid\mathrm{SnCl_2}\mid\mathrm{Tl_2Cl_2}\mid\mathrm{Tl}$	(350 − 550°C)	$E = 0·370 + 1·8 \times 10^{-4}(t - 427)$ V
$\mathrm{Sn}\mid\mathrm{SnCl_2}\mid\mathrm{KCl + LiCl}\mid\mathrm{Tl_2Cl_2}\mid\mathrm{Tl}$	(500 − 600°C)	$E = 0·367 + 1·5 \times 10^{-4}(t - 500)$ V
$\mathrm{Zn}\mid\mathrm{ZnCl_2}\mid\mathrm{CdCl_2}\mid\mathrm{Cd}$	(510 − 650°C)	$E = 0·148 - 1·3 \times 10^{-4}(t - 575)$ V
$\mathrm{Zn}\mid\mathrm{ZnCl_2}\mid\mathrm{PbCl_2}\mid\mathrm{Pb}$	(450 − 600°C)	$E = 0·276 - 9·5 \times 10^{-5}(t - 500)$ V
$\mathrm{Zn}\mid\mathrm{ZnCl_2}\mid\mathrm{SnCl_2}\mid\mathrm{Sn}$	(430 − 500°C)	$E = 0·306 - 1 \times 10^{-4}(t - 500)$ V
$\mathrm{Zn}\mid\mathrm{ZnCl_2}\mid\mathrm{TlCl}\mid\mathrm{Tl}$	(430 − 500°C)	$E = 0·110 + 4·8 \times 10^{-4}(t - 500)$ V

59 CONDUCTANCE OF PURE MOLTEN SALTS

κ = specific conductivity. Λ = equivalent conductivity

(a) Constants for the equations:

$$\kappa = a + b(t - t_1) \text{ ohm}^{-1} \text{ cm}^{-1}$$
and $$\Lambda = c + d(t - t_2) \text{ ohm}^{-1} \text{ cm}^2$$

Salt	a	$b \times 10^3$	t_1	c	$d \times 10^3$	t_2
AgBr	3·39	1·70	600	92·4	85	422
$BeCl_2$	0·0032	26	451	0·087	7·3	451
$BiCl_3$	0·44	1·4	266	10·2	47	227
CdI_2	0·19	2·1	389			
CuI	1·82	1·78	605			
Hg_2Cl_2	1·00	1·8	529			
$HgCl_2$	52×10^{-5}	5×10^{-4}	294	0·0025	0·015	277
$InCl_3$	0·42	9·0	594	14·7	−17	586
$InCl_2$	0·47	2·0	356	6·9	70	235
InCl	0·97	6·4	242	33·4	290	225
$LaCl_3$	1·14	3·3	868	29·0	85	860
LiF	20·3	100	905			
KF	4·14	4·5	860	61·8	180	846
NaF	3·15	8·3	1000	65·8	200	988
$NdCl_3$	0·69	2·8	775			
$PbCl_2$	1·48	4·6	508	40·7	150	498
$PrCl_3$	0·90	3·7	824			
$SnCl_2$	0·89	5·7	263	21·9	175	245
$TeCl_4$	0·12	1·1	236			
$ThCl_4$	0·67	1·8	814	16	50	765
TlCl	1·17	3·5	450	46·5	175	430
UCl_4	0·34	2·8	570			
WCl_5	0·67	2·3	250			
YCl_3	0·40	2·0	714	9·5	60	700
$ZnCl_2$	0·051	1·5	460			

(b) Constants for the equation: $\kappa = A \exp[-E/RT]$ ohm^{-1} cm^{-1}

Salt	A	E
AgCl	7·4	0·99
AgI	4·0	0·80
$BaCl_2$	10·5	4·15
$CaCl_2$	13·5	4·10
$CdBr_2$	5·4	2·75
$CdCl_2$	7·3	2·30
CsCl	6·6	3·33
CuCl	6·2	0·85
KBr	5·8	2·55
KCl	6·5	2·30
KI	5·5	2·75
LiBr	13·5	1·75
LiCl	11·5	1·15
$MgCl_2$	6·4	3·56
NaBr	7·4	1·84
NaCl	7·3	1·54
NaI	4·8	1·25
$PbBr_2$	16·0	4·35
RbCl	6·5	2·83
$SrCl_2$	11·0	4·00

60 THERMODYNAMIC FUNCTIONS FOR IONS IN AQUEOUS SOLUTION

Standard free energy (ΔG°), heat content (ΔH°), entropy (S°) and heat capacity (C_p°) at 25°C relative to the hydrogen ion. Standard free energy (ΔG°_{solv}), heat content (ΔH°_{solv}) and entropy (ΔS°_{solv}) changes in the reaction $E^z(g) + zH^+(aq) \rightarrow E^z(aq) + zH^+(g)$ at 25°C. The standard real potential (α_i^s) is the standard free energy change per mole on transferring ions of species i from the ideal vapour phase to the ideal solution phase when there is no net charge on the solution phase. Standard States: in solution; unit activity on molality scale: in gas; unit fugacity. ΔG°, ΔH°, ΔG°_{solv}, ΔH°_{solv} and α_i^s are in kcal mole^{-1}. S°, C_p° and ΔS°_{solv} are in cal deg^{-1} mole^{-1}.

Ion	ΔG°	ΔH°	S°	C_p°	ΔG°_{solv}	ΔH°_{solv}	ΔS°_{solv}	$-\alpha_i^s$
Ag^+	18·44	25·2	17·67		146·02	147·12	3·74	110·8
Ag^{2+}	63·15							357·3
$Ag(NH_3)^+$			57·8					
Al^{3+}	−115·5	−126·3	−74·9		−321·8	−331·6	−32·7	1086·7
Au^{3+}	98·2							
Ba^{2+}	−133·85	−128·4	3·0	−14·7		209·80		318·1
Be^{2+}	−78·7	−85	−27 a			−73		570·8
Ca^{2+}	−132·7	−129·5	−13·2	−8·7	140·23	140·77	1·8	374·0
Cd^{2+}	−18·55	−17·6	−14·6		90·54	89·76	−2·6	425·6
Ce^{3+}					−64	−67	−10	
Ce^{4+}						−508		
Co^{2+}	−12·8	−16·5	−27 a			30·4		459·7
Co^{3+}	28·9							1123·3
Cr^{2+}	−39·4	−43				79·3		449·8
Cr^{3+}	−49·0	−65	−73·5			−680		989·9
Cs^+	−70·28		31·8		192·7	197·8	17·2	68·8
Cu^+	12·04				124·3	118·7	−18·7	108·3
Cu^{2+}	15·91	−15	−23·6		23·77	19·45	−14·5	492·8
Er^{3+}		−158·79						
Fe^{2+}	−20·3	−20·6	−27·1			62·5		460·9
Fe^{3+}	−2·53	−9·3	−70·1		−254	−264	−33·6	1124·5
Ga^{3+}	−36·0		−83		−324·5	−337·6	−44	1048·5
Gd^{3+}		−163·01	−43					
H^+	0·00	0·00	0·00	0·0	0·00	0·00	0·00	257·3
Hg_2^{2+}	38·85	40·2	17·7					
Hg^{2+}	39·42	41·6	−5·4					432·1
In^{3+}			−62		−192·7	−199·9	−24	968·3
K^+	−67·43	−60·3	24·5	+0·6	179·92	183·98	13·6	78·6
La^{3+}	−163·8	−168·77				−2·5		796·7
Li^+	−70·7	−66·6	3·4	+13·8	138·390	137·674	−2·4	120·1
Mg^{2+}	−107·8	−110·2	−28·2	−5·7	65·47	61·98	−11·7	450·9
Mn^{2+}	−48·6	−49·2	−20	+5·5	83·2	80·4	−9·5	436·3
NH_4^+	−18·96	−31·5	26·4	+15·8		185		64
Na^+	−62·59	−57·5	14·4	+5·6	162·273	163·794	5·1	96·1
Ni^{2+}	−11·53	−15·2	−31 a			18·1		486·3
Pd^{2+}	45·7							497·1
Pb^{2+}	−5·81	−0·2	5·1		163·15	167·68	15·2	354·8
Pb^{4+}	−197·0		−84 a					1499·2
Pr^{3+}		−167·69						
Pu^{3+}			−39					
Pu^{4+}			−87					
Rb^+	−68·8	−61·0	29·7		185·0	189·9	16·5	74·9
Sc^{3+}	−138·0					−164		843·4
Sn^{2+}	−6·28		−5·9					374·6
Sn^{4+}	0·7		−95 a					1799·8
Sr^{2+}	−133·2	−130·0	−9·4	−11·4		176·05		341·6
Tl^+	−7·76	0·8	30·4		178·48	182·83	14·6	76·6
Tl^{3+}	49·74	28	−35 a			−217·9		965·7
Th^{4+}	72·20		−65 a					1819·2
U^{3+}			−36					
U^{4+}			−78					
V^{2+}	−70·0							433·7
V^{3+}	−75·9		−65 a					860·1
Y^{3+}	−145·0	−161·31	−34 a			−83·1		824·3
Zn^{2+}	−35·18	−36·3	−25·45	+4·2	36·36	32·84	−11·87	479·9
Br^-	−24·58	−28·7	19·25	−30·0	−326·0	−340·7	−45·79	70·8
Cl^-	−31·33	−39·9	13·17	−29·4	−334·0	−348·8	−49·49	77·2
ClO_3^-	−0·25	−20·8	39·4			−427·6		
F^-	−65·7	−78·2	−2·3	+4·1	−347·5	−366·3	−63·1	106·7
I^-	−12·33	−13·6	26·14	30·7	−318·3	−330·3	−40·32	62·8
OH^-	−37·59	−54·8	−2·5	32		−345·7		81
S^{2-}	23·42	10·0	−6·4		−824·6	−849·4	−83·1	320·0
SH^-	2·95	−3·9	14·9					64
AsO_4^{3-}	−153·4	−215						
BrO_3^-	5·0	−11·2	38·5					
CN^-	39·14	34·9	25					
CNS^-								
CO_3^{2-}	−126·4	−160·5	−13·0					
$C_2O_4^{2-}$	−158·7		9·6					
$C_6H_5COO^-$			27·9					
ClO^-			10·0					
ClO_2^-			24·1					
ClO_4^-	−10·7	−39·5	43·6					
CrO_4^-	−171·4	−207·9	10·6					
$H_2AsO_4^-$			28					
HCO_3^-	−140·5	−164·8	22·2					
HF_2^-			26					
HPO_4^{2-}	−257·3		8·7					
$H_2PO_4^-$	−267·1		21·6					
HSO_3^-	−125·9		32·6					
HSO_4^-		−213·3	30·6					
IO_3^-	−32·25	−54·5	28·0					
MnO_4^-	−100·6	−122·3	46·7					
NO_2^-	−8·45	−28·5	29·9					
NO_3^-	−26·25	−49·5	35·0					
PO_4^{3-}	−241·0	−229	−52					
SO_3^{2-}	−116·4	−149	3					
SO_4^{2-}	−176·1	−216·3	4·4					

a Approximate, calculated value.

Table 60 (cont.)

a Footnote on facing page.

61 IONS IN LIQUID AMMONIA

Standard free energy ($\Delta G°$) (kcal. mole^{-1}), heat content ($\Delta H°$) (kcal. mole^{-1}) and entropy ($S°$) (cal. mole^{-1} deg^{-1}) relative to H^+

Ion	$\Delta G°$	$\Delta H°$	$S°$	Ion	$\Delta G°$	$\Delta H°$	$S°$
Ag^+	17·5	26	23	BH_4^-		15·7	
Ca^{2+}	−100·0	−100·0	−21	Br^-	−39·9	−59·0	−30·3
Cs^+	−47·5	−39	29	CNS^-		−11·8	
H^+	0·0	0·0	0·0	Cl^-	−44·1	−65·7	−30·3
Hg^{2+}	31	45·2	35	ClO_3^-	−17·7	−47·7	15
K^+	−47·0	−40·5	21·4	e^-		43·5	
Li^+	−54	−49	8	$\frac{1}{2}e_2^{2-}$	44·4	40·5	2
Mn^{2+}	−26			F^-	−80·8		
NH_4^+	−2·7	−16·1	24·7	I^-	−29	−45·3	−25
Na^+	−43·6	−38·1	15·1	IO_3^-	−42·4		
Pb^{2+}	13	21·0	11	NH_2^-	34	10·1	−10
Rb^+	−47·5	−39	29	NO_3^-	−42·8	−77·6	−5
Tl^+	5·7			Se_2^{2-}		−19·0	
Zn^+	−25			Te_2^{2-}		−27·8	
				Te_4^{2-}		−29·7	

62 METHANOL + WATER MIXTURES

Standard free energy ($\Delta G°$) (kcal. mole^{-1}), heat content ($\Delta H°$) (kcal. mole^{-1}) and entropy ($S°$) (cal. mole^{-1} deg^{-1}) of ions at 25°C relative to the hydrogen ion.

Wt % MeOH	K^+			Na^+			Br^-			Cl^-		
	$-\Delta G°$	$-\Delta H°$	$S°$	$-\Delta G°$	$-\Delta H°$	$S°$	$-\Delta G°$	$-\Delta H°$	$S°$	$-\Delta G°$	$-\Delta H°$	$S°$
10	67·24	60·26	23·5	62·02	57·29	13·6	24·44	28·79	20·0	31·19	39·61	14·1
20	66·94	60·31	22·3	61·90	57·24	12·7	24·37	28·56	20·6	31·04	39·38	14·4
30	66·71	60·42	21·1	61·59	57·29	11·5	24·27	28·53	20·4	30·92	39·26	14·4
40	66·42	60·46	20·0	61·31	57·28	10·6	24·15	28·69	19·5	30·76	39·30	13·7
50	66·08	60·52	18·7	61·05	57·21	10·0	24·01	29·03	17·9	30·56	39·50	12·4
60	65·56	60·63	16·6	60·68	57·12	9·1	23·99	29·40	16·5	30·32	39·80	10·5
70	64·92	60·81	13·7	60·40	57·18	7·9	23·80	29·76	14·9	29·99	40·09	8·5
80	64·36	60·95	11·5	60·15	57·24	6·8	23·37	30·33	11·3	29·51	40·56	5·3
90	63·94	61·15	9·4	60·33	57·56	6·3	22·59	31·93	6·7	28·66	41·09	0·7
100	65·57	61·46	13·8	62·29	58·54	11·4	20·18	31·77	−4·1	25·99	41·76	−10·5

Solvation numbers are given by:

BOCKRIS, J.O'M., *Quart. Rev.*, 3 (1949) 173
ROBINSON, R. A. and STOKES, R. H., *Electrolyte Solutions*, Butterworths, London, 1955

63 STANDARD ELECTRODE POTENTIALS (REDUCTION POTENTIALS) FOR INORGANIC SYSTEMS AT 25°C

(*a*) Aqueous Acid Solutions. $E°$ on molarity scale in volts

Electrode reaction	$E°$	Electrode reaction	$E°$
$\frac{3}{2}N_2+e^-=N^-_3$	−3·09	$TlI+e^-=Tl+I^-$	−0·753
$Li^++e^-=Li$	−3·045	$Cr^{3+}+3e^-=Cr$	−0·74
$K^++e^-=K$	−2·925	$Te+2H^++2e^-=H_2Te$	−0·72
$Rb^++e^-=Rb$	−2·925	$TlBr+e^-=Tl+Br^-$	−0·658
$As^++e^-=As$	−2·923	$Nb_2O_5+10H^++10e^-=2Nb+5H_2O$	−0·65
$Ra^{2+}+2e^-=Ra$	−2·92	$U^{4+}+e^-=U^{3+}$	−0·61
$Ba^{2+}+2e^-=Ba$	−2·90	$As+3H^++3e^-=AsH_3$	−0·60
$Sr^{2+}+2e^-=Sr$	−2·89	$TlCl+e^-=Tl+Cl^-$	−0·557
$Ca^{2+}+2e^-=$ Ca	−2·87	$Ga^{3+}+3e^-=Ga$	−0·53
$Na^++e^-=Na$	−2·714	$Sb+3H^++3e^-=SbH_3(g)$	−0·51
$La^{3+}+3e^-=La$	−2·52	$H_3PO_2+H^++e^-=P+2H_2O$	−0·51
$Ce^{3+}+3e^-=Ce$	−2·48	$H_3PO_3+2H^++2e^-=H_2PO_2+H_2O$	−0·50
$Nd^{3+}+3e^-=Nd$	−2·44	$Fe^{2+}+2e^-=Fe$	−0·440
$Sm^{3+}+3e^-=Sm$	−2·41	$Eu^{3+}+e^-=Eu^{2+}$	−0·43
$Gd^{3+}+3e^-=Gd$	−2·40	$Cr^{3+}+e^-=Cr^{2+}$	−0·41
$Mg^{2+}+2e^-=Mg$	−2·37	$Cd^{2+}+2e^-=Cd$	−0·403
$Y^{3+}+3e^-=Y$	−2·37	$Se+2H^++2e^-=H_2Se$	−0·40
$Am^{3+}+3e^-=Am$	−2·32	$Ti^{3+}+e^-=Ti^{2+}$	(−0·37)
$Lu^{3+}+3e^-=Lu$	−2·25	$PbI_2+2e^-=Pb+2I^-$	−0·365
$\frac{1}{2}H_2+e^-=H^-$	−2·25	$PbSO_4+2e^-=Pb+SO_4^{2-}$	−0·356
$H^++e^-=H(g)$	−2·10	$In^{3+}+3e^-=In$	−0·342
$Sc^{3+}+3e^-=Sc$	−2·08	$Tl^++e^-=Tl$	−0·336
$Pu^{3+}+3e^-=Pu$	−2·07	$PtS+2H^++2e^-=Pt+H_2S$	−0·30
$AlF_6^{3-}+3e^-=Al+6F^-$	−2·07	$PbBr_2+2e^-=Pb+2Br^-$	−0·280
$Th^{4+}+4e^-=Th$	−1·90	$Co^{2+}+2e^-=Co$	−0·277
$Np^{3+}+3e^-=Np$	−1·86	$H_3PO_4+2H^++2e^-=H_3PO_3+H_2O$	−0·276
$Be^{2+}+2e^-=Be$	−1·85	$PbCl_2+2e^-=Pb+2Cl^-$	−0·268
$U^{3+}+3e^-=U$	−1·80	$V^{3+}+e^-=V^{2+}$	−0·255
$Hf^{4+}+4e^-=Hf$	−1·70	$V(OH)_4^++4H^++5e^-=V+4H_2O$	−0·253
$Al^{3+}+3e^-=Al$	−1·66	$SnF_6^{2-}+4e^-=Sn+6F^-$	−0·25
$Ti^{2+}+2e^-=Ti$	−1·63	$Ni^{2+}+2e^-=Ni$	−0·250
$Zr^{4+}+4e^-=Zr$	−1·53	$N_2+5H^++4e^-=N_2H_5^+$	−0·23
$SiF_6^{2-}+4e^-=Si+6F^-$	−1·2	$2SO_4^{2-}+4H^++2e^-=S_2O_6^{2-}+2H_2O$	−0·22
$TiF_6^{2-}+4e^-=Ti+6F^-$	−1·19	$Mo^{3+}+3e^-=Mo$	(−0·2)
$Mn^{2+}+2e^-=Mn$	−1·18	$CO_2+2H^++2e^-=HCOOH(aq)$	−0·196
$V^{2+}+2e^-=V$	(−1·18)	$CuI+e^-=Cu+I^-$	−0·185
$Nb^{3+}+3e^-=Nb$	(−1·1)	$AgI+e^-=Ag+I^-$	−0·151
$TiO^{2+}+2H^++4e^-=Ti+H_2O$	−0·89	$Sn^{2+}+2e^-=Sn$	−0·136
$H_3BO_3+3H^++3e^-=B+3H_2O$	−0·87	$O_2+H^++e^-=HO_2$	−0·13
$SiO_2+4H^++4e^-=Si+2H_2O$	−0·86	$Pb^{2+}+2e^-=Pb$	−0·126
$Ta_2O_5+10H^++10e^-=2Ta+5H_2O$	−0·81	$GeO_2+4H^++4e^-=Ge+2H_2O$	−0·15
$Zn^{2+}+2e^-=Zn$	−0·763	$WO_3(c)+6H^++6e^-=W+3H_2O$	−0·09

Table 63 (cont.)

Electrode reaction	$E°$
$2H_2SO_3+H^++2e^-=HS_2O_4^-+2H_2O$	-0·08
$HgI_4^{2-}+2e^-=Hg+4I^-$	-0·04
$2H^++2e^-=H_2$	0·000
$Ag(S_2O_3)_2^3+e^-=Ag+2S_2O_3^{2-}$	0·01
$CuBr+e^-=Cu+Br^-$	0·033
$UO_2^{2+}+e^-=UO_2^+$	0·05
$HCOOH(aq)+2H^++2e^-=HCHO(\mathrm{aq.})+H_2O$	0·056
$P+3H^++3e^-=PH_3(g)$	0·06
$AgBr+e^-=Ag+Br^-$	0·095
$TiO^{2+}+2H^++e^-=Ti^{3+}+H_2O$	0·1
$Si+4H^++4e^-=SiH_4$	0·102
$C+4H^++4e^-=CH_4$	0·13
$CuCl+e^-=Cu+Cl^-$	0·137
$S+2H^++2e^-=H_2S$	0·141
$Np^{4+}+e^-=Np^{3+}$	0·147
$Sn^{4+}+2e^-=Sn^{2+}$	0·15
$Sb_2O_3+6H^++6e^-=2Sb+3H_2O$	0·152
$Cu^{2+}+e^-=Cu^+$	0·153
$BiOCl+2H^++3e^-=Bi+H_2O+Cl^-$	0·16
$SO_4^{2-}+4H^++2e^-=H_2SO_3+H_2O$	0·17
$HCHO(aq)+2H^++2e^-=CH_3OH(aq)$	0·19
$HgBr_4^{2-}+2e^-=Hg+4Br^-$	0·21
$AgCl+e^-=Ag+Cl^-$	0·222
$HAsO_2(aq)+3H^++3e^-=As+2H_2O$	0·247
$ReO_2+4H^++4e^-=Re+2H_2O$	0·252
$BiO^++2H^++3e^-=Bi+H_2O$	0·32
$HCNO+H^++e^-=\frac{1}{2}C_2N_2+H_2O$	0·33
$UO_2^{2+}+4H^++2e^-=U^{4+}+2H_2O$	0·334
$Cu^{2+}+2e^-=Cu$	0·337
$AgIO_3+e^-=Ag+IO_3^-$	0·35
$Fe(CN)_6^{3-}+e^-=Fe(CN)_6^{4-}$	0·36
$VO^{2+}+2H^++e^-=V^{3+}+H_2O$	0·361
$ReO_4^-+8H^++7e^-=Re+4H_2O$	0·363
$\frac{1}{2}C_2N_2+H^++e^-=HCN(aq)$	0·37
$2H_2SO_3+2H^++4e^-=S_2O_3^{2-}+3H_2O$	0·40
$RhCl_6^{3-}+3e^-=Rh+6Cl^-$	0·44
$Ag_2CrO_4+2e^-=2Ag+CrO_4^{2-}$	0·446
$H_2SO_3+4H^++4e^-=S+3H_2O$	0·45
$Sb_2O_5+2H^++2e^-=Sb_2O_4+H_2O$	0·48
$Ag_2MoO_4+2e^-=2Ag+MoO_4^{2-}$	0·49
$H_2N_2O_2+6H^++4e^-=2NH_3OH^+$	0·496
$ReO_4^-+4H^++3e^-=ReO_2+2H_2O$	0·51
$4H_2SO_4+4H^++6e^-=S_4O_6^{2-}+6H_2O$	0·51
$C_2H_4+2H^++2e^-=C_2H_6$	0·52
$Cu^++e^-=Cu$	0·521

Electrode reaction	$E°$
$TeO_2(c)+4H^++4e^-=Te+2H_2O$	0·529
$I_2+2e^-=2I^-$	0·536
$I_3^-+2e^-=3I^-$	0·536
$Cu^{2+}+Cl^-+e^-=CuCl$	0·538
$AgBrO_3+e^-=Ag+BrO_3^-$	0·55
$TeOOH^++3H^++4e^-=Te+2H_2O$	0·559
$H_3AsO_4+2H^++2e^-=HAsO_2+2H_2O$	0·559
$AgNO_2+e^-+Ag+NO_2^-$	0·564
$MnO_4^-+e^-=MnO_4^{2-}$	0·564
$PtBr_4^{2-}+2e^-=Pt+4Br^-$	0·58
$Sb_2O_5+6H^++4e^-=2SbO^++3H_2O$	0·581
$CH_3OH(aq)+2H^++2e^-=CH_4+H_2O$	0·586
$PdBr_4^{2-}+2e^-=Pd+4Br^-$	0·6
$RuCl_5^{2-}+3e^-=Ru+5Cl^-$	0·60
$UO_2^{2+}+4H^++2e^-=U^{4+}+2H_2O$	0·62
$PdCl_4^{2-}+2e^-=Pd+4Cl^-$	0·62
$Cu^{2+}+Br^-+e^-=CuBr$	0·640
$AgC_2H_3O_2+e^-=Ag+C_2H_3O_2^-$	0·643
$Ag_2SO_4+2e^-=2Ag+SO_4^{2-}$	0·653
$Au(CNS)_4^-+3e^-=Au+4CNS^-$	0·66
$PtCl_6^{2-}+2e^-=PtCl_4^{2-}+2Cl^-$	0·68
$O_2+2H^++2e^-=H_2O_2$	0·682
$HN_3+11H^{2+}8e^-=3NH_4^+$	0·69
$Te+2H^++2e^-=H_2Te$	0·70
$2NO+2H^++2e^-=H_2N_2O_2$	0·71
$H_2O_2+H^++e^-=OH+H_2O$	0·72
$PtCl_4^{2-}+2e^-=Pt+4Cl^-$	0·73
$C_2H_2+2H^++2e^-=C_2H_4$	0·73
$H_2SeO_3+4H^++4e^-=Se+3H_2O$	0·74
$NpO_2^++4H^++e^-=Np^{4+}+2H_2O$	0·75
$(CNS)_2+2e^-=2CNS^-$	0·77
$IrCl_6^{3-}+3e^-=Ir+6Cl^-$	0·77
$Fe^{3+}+e^-=Fe^{2+}$	0·771
$Hg_2^{2+}+2e^-=2Hg$	0·789
$Ag^++e^-=Ag$	0·799
$2NO_3^-+4H^++2e^-=N_2O_4+2H_2O$	0·80
$Rh^{3+}+3e^-=Rh$	(0·8)
$OsO_4(c)+8H^++8e^-=Os+4H_2O$	0·85
$2HNO_2+4H^++4e^-=H_2N_2O_2+2H_2O$	0·86
$Cu^{2+}+I^-+e^-=CuI$	0·86
$AuBr_4^-+3e^-=Au+4Br^-$	0·87
$2Hg^{2+}+2e^-=Hg_2^{2+}$	0·920
$NO_3^-+3H^++2e^-=HNO_2+H_2O$	0·94
$PuO_2^{2+}+e^-=PuO_2^+$	0·93
$NO_3^-+4H^++4e^-=NO+2H_2O$	0·96
$AuBr_2^-+e^-=Au+2Br^-$	0·96

Table 63 (cont.)

Electrode reaction	$E°$
$Pu^{4+}+e^-=Pu^{3+}$	0·97
$Pt(OH)_2+2H^++2e^-=Pt+2H_2O$	0·98
$Pd^{2+}+2e^-=Pd$	0·987
$IrBr_6^{3-}+e^-=IrBr_6^{4-}$	0·99
$HNO_2+H^++e^-=NO+H_2O$	1·00
$AuCl_4^-+3e^-=Au+4Cl^-$	1·00
$V(OH)_4^++2H^++e^-=VO^{2+}+3H_2O$	1·00
$IrCl_6^{2-}+e^-=IrCl_6^{3-}$	1·017
$H_6TeO_6+2H^++2e^-=TeO_2+4H_2O$	1·02
$N_2O_4+4H^++4e^-=NO+2H_2O$	1·03
$PuO_2^{2+}+4H^++2e^-=Pu^{4+}+2H_2O$	1·04
$ICl_2^-+e^-=\frac{1}{2}I_2+2Cl^-$	1·06
$Br_2(l)+2e^-=2Br^-$	1·065
$N_2O_4+2H^++2e^-=2HNO_2$	1·07
$Cu^{2+}+2CN^-+e^-=Cu(CN)_2^-$	1·12
$PuO_2^++4H^++e^-=Pu^{4+}+2H_2O$	1·15
$SeO_4^{2-}+4H^++2e^-=H_2SeO_3+H_2O$	1·15
$NpO_2^{2+}+e^-=NpO_2^+$	1·15
$CCl_4+4H^++4e^-=C+4Cl^-+4H^+$	1·18
$ClO_4^-+2H^++2e^-=ClO_3^-+H_2O$	1·19
$IO_3^-+6H^++5e^-=\frac{1}{2}I_2+3H_2O$	1·195
$ClO_3^-+3H^++2e^-=HClO_2+H_2O$	1·21
$O_2+4H^++4e^-=2H_2O$	1·229
$S_2Cl_2+2e^-=2S+2Cl^-$	1·23
$MnO_2+4H^++2e^-=Mn^{2+}+2H_2O$	1·23
$Tl^{3+}+2e^-=Tl^+$	1·25
$AmO_2^++4H^++e^-=Am^{4+}+2H_2O$	1·26
$N_2H_5^++3H^++2e^-=2NH_4^+$	1·275
$ClO_2+H^++e^-=HClO_2$	1·275
$PdCl_6^{2-}+2e^-=PdCl_4^{2-}+2Cl^-$	1·288
$2HNO_2+4H^++4e^-=N_2O+3H_2O$	1·29
$Cr_2O_7^{2-}+14H^++6e^-=2Cr^{3+}+7H_2O$	1·33
$NH_3OH^++2H^++2e^-=NH_4^++H_2O$	1·35
$Cl_2+2e^-=2Cl^-$	1·360
$2NH_3OH^++H^++2e^-=N_2H_5^++2H_2O$	1·42
$Au(OH)_3+3H^++3e^-=Au+3H_2O$	1·45
$HIO+H^++e^-=\frac{1}{2}I_2+H_2O$	1·45
$PbO_2+4H^++2e^-=Pb^{2+}+2H_2O$	1·455
$Au^{3+}+3e^-=Au$	1·50
$HO_2+H^++e^-=H_2O_2$	1·5
$Mn^{3+}+e^-=Mn^{2+}$	1·51
$MnO_4^-+8H^++5e^-=Mn^{2+}+4H_2O$	1·51
$BrO_3^-+6H^++5e^-=\frac{1}{2}Br_2+3H_2O$	1·52
$HBrO+H^++e^-=\frac{1}{2}Br_2+H_2O$	1·59
$Bi_2O_4+4H^++2e^-=2BiO^++2H_2O$	1·59
$H_5IO_6+H^++2e^-=IO_3^-+3H_2O$	1·6

Electrode reaction	$E°$
$Bk^{4+}+e^-=Bk^{3+}$	1·6
$Ce^{4+}+e^-=Ce^{3+}$	1·61
$HClO+H^++e^-=\frac{1}{2}Cl_2+H_2O$	1·63
$AmO_2^{2+}+e^-=AmO_2^+$	1·64
$HClO_2+2H^++2e^-=HClO+H_2O$	1·64
$NiO_2+4H^++2e^-=Ni^{2+}+2H_2O$	1·68
$PbO_2+SO_4^{2-}+4H^++2e^-=PbSO_4+2H_2O$	1·685
$AmO_2^{2+}+4H^++3e^-=Am^{3+}+2H_2O$	1·69
$MnO_4^-+4H^++3e^-=MnO_2+2H_2O$	1·695
$Au^++e^-=Au$	(1·7)
$AmO_2^++4H^++2e^-=Am^{3+}+2H_2O$	1·725
$H_2O_2+2H^++2e^-=2H_2O$	1·77
$Co^{3+}+e^-=Co^{2+}$	1·82
$FeO_4^{2-}+8H^++3e^-=Fe^{3+}+4H_2O$	1·9
$HN_3+3H^++2e^-=NH_4^++N_2$	1·96
$Ag^{2+}+e^-=Ag^+$	1·98
$S_2O_8^{2-}+2e^-=2SO_4^{2-}$	2·01
$O_3+2H^++2e^-=O_2+H_2O$	2·07
$F_2O+2H^++4e^-=2F^-+H_2O$	2·1
$Am^{4+}+e^-=Am^{3+}$	2·18
$O(g)+2H^++2e^-=H_2O$	2·42
$F_2+2e^-=2F^-$	2·65
$OH+H^++e^-=H_2O$	2·8
$H_2N_2O_2+2H^++2e^-=N_2+2H_2O$	2·85
$F_2+2H^++2e^-=2HF(aq)$	3·06

(*b*) AQUEOUS BASIC SOLUTIONS

Electrode reaction	$E°$
$Ca(OH)_2+2e^-=Ca+2OH^-$	-3·03
$Sr(OH)_28H_2O+2e^-=Sr+2OH^-+8H_2O$	-2·99
$Ba(OH)_28H_2O+2e^-=Ba+2OH^-+8H_2O$	-2·97
$H_2O+e^-=H(g)+OH^-$	-2·93
$La(OH)_3+3e^-=La+3OH^-$	-2·90
$Lu(OH)_3+3e^-=Lu+3OH^-$	-2·72
$Mg(OH)_2+2e^-=Mg+2OH^-$	-2·69
$Be_2O_3^{2-}+3H_2O+4e^-=2Be+6OH^-$	-2·62

Table 63 (*cont.*)

Electrode reaction	$E°$
$Sc(OH)_3 + 3e^- = Sc + 3OH^-$	(−2·6)
$HfO(OH)_2 + H_2O + 4e^- = Hf + 4OH^-$	−2·50
$Th(OH)_4 + 4e^- = Th + 4OH^-$	−2·48
$Pu(OH)_3 + 3e^- = Pu + 3OH^-$	−2·42
$UO_2 + 2H_2O + 4e^- = U + 4OH^-$	−2·39
$H_2AlO_3^- + H_2O + 3e^- = Al + 4OH^-$	−2·35
$H_2ZrO_3 + H_2O + 4e^- = Zr + 4OH^-$	−2·36
$U(OH)_4 + e^- = U(OH)_3 + OH^-$	−2·2
$U(OH)_3 + 3e^- = U + 3OH^-$	−2·17
$H_2PO_2^- + e^- = P + 2OH^-$	−2·05
$H_2BO_3^- + 3e^- = B + 4OH^-$	−1·79
$SiO_3^{2-} + 3H_2O + 4e^- = Si + 6OH^-$	−1·70
$Na_2UO_4 + 4H_2O + 2e^- = U(OH)_4 + 2Na^+ + 4OH^-$	−1·61
$HPO_3^{2-} + 2H_2O + 2e^- = H_2PO_2^- + 3OH^-$	−1·57
$Mn(OH)_2 + 2e^- = Mn + 2OH^-$	−1·55
$MnCO_3 + 2e = Mn + CO_3^{2-}$	−1·48
$ZnS + 2e^- = Zn + S^{2-}$	−1·44
$Cr(OH)_3 + 3e^- = Cr + 3OH^-$	−1·3
$Zn(CN)_4^{2-} + 2e^- = Zn + 4CN^-$	−1·26
$Zn(OH)_2 + 2e^- = Zn + 2OH^-$	−1·245
$H_2GaO_3^- + H_2O + 3e^- = Ga + 4OH^-$	−1·22
$ZnO_2^{2-} + 2H_2O + 2e^- = Zn + 4OH^-$	−1·216
$CrO_2^- + 2H_2O + 3e^- = Cr + 4OH^-$	−1·2
$CdS + 2e^- = Cd + S^{2-}$	−1·21
$HV_6O_{17} + 16H_2O + 30e^- = 6V + 33OH^-$	−1·15
$Te + 2e^- = Te^{2-}$	−1·14
$PO_4^{3-} + 2H_2O + 2e^- = HPO_3^{2-} + 3OH^-$	−1·12
$2SO_3^{2-} + 2H_2O + 2e^- = S_2O_4^{2-} + 4OH^-$	−1·12
$ZnCO_3 + 2e^- = Zn + CO_3^{2-}$	−1·06
$WO_4^{2-} + 4H_2O + 6e^- = W + 8OH^-$	−1·05
$MoO_4^{2-} + 4H_2O + 6e^- = Mo + 8OH^-$	−1·05
$Cd(CN)_4^{2-} + 2e^- = Cd + 4CN^-$	−1·03
$Zn(NH_3)_4^{2+} + 2e^- = Zn + 4NH_3$	−1·03
$FeS(\alpha) + 2e^- = Fe + S^{2-}$	−1·01
$In(OH)_3 + 3e^- = In + 3OH^-$	−1·0
$PbS + 2e^- = Pb + 2^{2-}$	−0·98
$CNO^- + H_2O + 2e^- = CN^- + 2OH^-$	−0·97
$Tl_2S + 2e^- = Tl + S^{2-}$	−0·96
$Pu(OH)_4 + e^- = Pu(OH)_3 + OH^-$	−0·95
$SnS + 2e^- = Sn + S^{2-}$	−0·94
$SO_4^{2-} + H_2O + 2e^- = SO_3^{2-} + 2OH^-$	−0·93
$Se + 2e^- = Se^{2-}$	−0·92
$HSnO_3^- + H_2O + 2e^- = Sn + 3OH$	−0·91
$HGeO_3^- + 2H_2O + 4e^- = Ge + 5OH^-$	−0·9
$Sn(OH)_6^{2-} + 2e^- = HSnO_2^- + H_2O + 3OH^-$	−0·90
$P + 3H_2O + 3e^- = PH_3 + 3OH^-$	−0·89
$Fe(OH)_2 + 2e^- = Fe + 2OH^-$	−0·877
$NiS(\alpha) + 2e^- = Ni + S^{2-}$	−0·83
$2H_2O + 2e^- = H_2 + 2OH^-$	−0·828
$Cd(OH)_2 + 2e^- = Cd + 2OH^-$	−0·809
$FeCO_3 + 2e^- = Fe + CO_3^{2-}$	−0·756
$CdCO_3 + 2e^- = Cd + CO_3^{2-}$	−0·74
$Co(OH)_2 + 2e^- = Co + 2OH^-$	−0·73
$HgS + 2e^- = Hg + S^{2-}$	−0·72
$Ni(OH)_2 + 2e^- = Ni + 2OH^-$	−0·72
$Ag_2S + 2e^- = 2Ag + S^{2-}$	−0·69
$AsO_2^- + 2H_2O + 3e^- = As + 4OH^-$	−0·68
$AsO_4^{3-} + 2H_2O + 2e^- = AsO_2^- + 4OH^-$	−0·67
$Fe_2S_3 + 2e^- = 2FeS + S^{2-}$	−0·67
$SbO_2^- + 2H_2O + 3e^- = Sb + 4OH^-$	−0·66
$CoCO_3 + 2e^- = Co + CO_3^{2-}$	−0·64
$Cd(NH_3)_4^{2+} + 2e^- = Cd + 4NH_3$	−0·597
$ReO_4^- + 2H_2O + 3e^- = ReO_2 + 4OH^-$	−0·594
$ReO_4^- + 4H_2O + 7e^- = Re + 8OH^-$	−0·584
$2SO_3^{2-} + 3H_2O + 4e^- = S_2O_3^{2-} + 6OH^-$	−0·58
$ReO_2 + H_2O + 4e^- = Re + 4OH^-$	−0·576
$TeO_3^{2-} + 3H_2O + 4e^- = Te + 6OH^-$	−0·57
$Fe(OH)_3 + e^- = Fe(OH)_2 + OH^-$	−0·56
$O_2 + e^- = O_2^-$	−0·56
$Cu_2S + 2e^- = 2Cu + S^{2-}$	−0·54
$HPbO_2^- + H_2O + 2e^- = Pb + 3OH^-$	−0·54
$PbCO_3 + 2e^- = Pb + CO_3^{2-}$	−0·506
$S + 2e^- = S^{2-}$	−0·48
$Ni(NH_3)_6^{2+} + 2e^- = Ni + 6NH_3(aq)$	−0·47
$NiCO_3 + 2e^- = Ni + CO_3^{2-}$	−0·45
$Bi_2O_3 + 3H_2O + 6e^- = 2Bi + 6OH^-$	−0·44
$Cu(CN)_2^- + e^- = Cu + 2CN^-$	−0·43
$Hg(CN)_4^{2-} + 2e^- = Hg + 4CN^-$	−0·37
$SeO_3^{2-} + 3H_2O + 4e^- = Se + 6OH^-$	−0·366
$Cu_2O + H_2O + 2e^- = 2Cu + 2OH^-$	−0·358
$Tl(OH) + e^- = Tl + OH^-$	−0·345
$Ag(CN)_2^- + e^- = Ag + 2CN^-$	−0·31
$CuCNS + e^- = Cu + CNS^-$	−0·27
$HO_2^- + H_2O + e^- = OH + 2OH^-$	−0·24
$CrO_4^{2-} + 4H_2O + 3e^- = Cr(OH)_3 + 5OH^-$	−0·13
$Cu(NH_3)_2^+ + e^- = Cu + 2NH_3$	−0·12
$2Cu(OH)_2 + 2e^- = Cu_2O + 2OH^-$	−0·080
$O_2 + H_2O + 2e^- = HO_2^- + OH^-$	−0·076

Table 63 (*cont.*)

Electrode reaction	$E°$
$Tl(OH)_3 + 2e^- = TlOH + 2OH^-$	−0·05
$AgCN + e^- = Ag + CN^-$	−0·017
$MnO_2 + H_2O + 2e^- = Mn(OH)_2 + 2OH^-$	−0·05
$NO_3^- + H_2O + 2e^- = NO_2^- + 2OH^-$	0·01
$HOsO_5^- + 4H_2O + 8e^- = Os + 9OH^-$	0·02
$Rh_2O_3 + 3H_2O + 6e^- = 2Rh + 6OH^-$	0·04
$SeO_4^{2-} + H_2O + 2e^- = SeO_3^{2-} + 2OH^-$	0·05
$Pd(OH)_2 + 2e^- = Pd + 2OH^-$	0·07
$S_4O_6^{2-} + 2e^- = 2S_2O_3^{2-}$	0·08
$HgO(r) + H_2O + 2e^- = Hg + 2OH^-$	0·098
$N_2H_4 + 4H_2O + 2e^- = 2NH_4OH + 2OH^-$	0·1
$Ir_2O_3 + 3H_2O + 6e^- = Ir + 6OH^-$	0·1
$Co(NH_3)_6^{3+} + e^- = Co(NH_3)_6^{2+}$	0·1
$Mn(OH)_3 + e^- = Mn(OH)_2$	0·1
$Pt(OH)_2 + e^- = Pt + 2OH^-$	0·15
$Co(OH)_3 + e^- = Co(OH)_2 + OH^-$	0·17
$PbO_2 + H_2O + 2e^- = PbO(r) + 2OH^-$	0·248
$IO_3^- + 3H_2O + 6e^- = I^- + 6OH^-$	0·26
$PuO_2(OH)_2 + e^- = PuO_2OH + OH^-$	0·26
$Ag(SO_3)_2^{2-} + e^- = Ag + 2SO_3^{2-}$	0·30
$ClO_3^- + H_2O + 2e^- = ClO_2^- + 2OH^-$	0·33
$Ag_2O + H_2O + 2e^- = 2Ag + 2OH^-$	0·344
$ClO_4^- + H_2O + 2e^- = ClO_3^- + 2OH^-$	0·36
$Ag(NH_3)_2^+ + e^- = Ag + 2NH_3$	0·373
$TeO_4^{2-} + H_2O + 2e^- = TeO_3^{2-} + 2OH^-$	0·4
$O_2^- + H_2O + e^- = OH^- + HO_2^-$	0·4
$O_2 + 2H_2O + 4e^- = 4OH^-$	0·401
$Ag_2CO_3 + 2e^- = 2Ag + CO_3^{2-}$	0·47
$NiO_2 + 2H_2O + 2e^- = Ni(OH)_2 + 2OH^-$	0·49
$IO^- + H_2O + 2e^- = I^- + 2OH^-$	0·49
$2AgO + H_2O + 2e^- = Ag_2O + 2OH^-$	0·57
$MnO_4^{2-} + 2H_2O + 2e^- = MnO_2 + 4OH^-$	0·60
$RuO_4^- + e^- = RuO_4^{2-}$	0·60
$BrO_3^- + 3H_2O + 6e^- = Br^- + 6OH^-$	0·61
$ClO_2^- + H_2O + 2e^- = ClO^- + 2OH^-$	0·66
$H_3IO_6^{2-} + 2e^- = IO_3^- + 3OH^-$	0·7
$2NH_2OH + 2e^- = N_2H_4 + 2OH^-$	0·73
$Ag_2O_3 + H_2O + 2e^- = 2AgO + 2OH^-$	0·74
$BrO^- + H_2O + 2e^- = Br^- + 2OH^-$	0·76
$HO_2^- + H_2O + 2e^- = 3OH^-$	0·88
$ClO^- + H_2O + 2e^- = Cl^- + 2OH^-$	0·89
$FeO_4^{2-} + 2H_2O + 3e^- = FeO_2^- + 4OH^-$	0·9
$ClO_2 + e^- = ClO_2^-$	1·16
$O_3 + H_2O + 2e^- = O_2 + 2OH^-$	1·24
$OH + e^- = OH^-$	2·0

64 STANDARD ELECTRODE POTENTIALS (REDUCTION POTENTIALS) IN NON-AQUEOUS SOLUTIONS AT 25°C

$E°$ on molarity scale in volts

	MeOH	EtOH	HCOOH	MeCN	N_2H_4	$HCONH_2$
$Li^+ + e^- = Li$	−3·095	−3·042	−3·48	−3·23	−2·20	
$Na^+ + e^- = Na$	−2·728	−2·657	−3·42	−2·87	−1·83	
$K^+ + e^- = K$			−3·36	−3·16	−2·02	−2·872
$Rb^+ + e^- = Rb$			−3·45	−3·17	−2·01	−2·855
$Cs^+ + e^- = Cs$			−3·44	−3·16		
$Ca^{2+} + 2e^- = Ca$			−3·20	−2·75	−1·91	
$Cu^{2+} + 2e^- = Cu$	+0·490	+0·21	−0·14	−0·28		+0·279
$Ag^+ + e^- = Ag$	+0·764	+0·749	0·17	+0·23	+0·77	
$Zn^{2+} + e^- = Zn$	−0·74	−0·64	−1·05	−0·74	−0·41	−0·757
$Cd^{2+} + e^- = Cd$	−0·258	−0·38	−0·75	−0·47	−0·10	−0·408
$Hg_2^{2+} + 2e = 2Hg$	+0·74	+0·76	0·18			
$Tl^+ + e^- = Tl$	−0·379	−0·343				−0·344
$Pb^{2+} + 2e^- = Pb$	−0·20	−0·15	−0·72	−0·12	+0·35	−0·193
$H^+ + e^- = \frac{1}{2}H_2$	0·0	0·0	0·0	0·0	0·0	0·0
$Cl_2 + 2e^- = 2Cl^-$	+1·116	+1·048		+0·58		
$Br_2 + 2e^- = 2Br^-$	+0·837	+0·777		+0·47		
$I_2 + 2e^- = 2I^-$	+0·357	+0·305		+0·07		

For Liquid Ammonia see Table 61

65 STANDARD E.M.F. ON MOLALITY SCALE OF THE CELL H_2|HCl|AgCl, Ag IN VARIOUS SOLVENTS AT VARIOUS TEMPERATURES

Compositions are given as weight % of non-aqueous component in the solvent. *E* is given in volts.

°C		50%	Methanol						
	Water	Glycerol	10%	20%	43·3%	64%	84·2%	94·2%	100%
0	0·23655	0·20065	0·22762	0·22022					
5	0·23413	0·19760	0·22547	0·21837					
10	0·23142	0·19441	0·22328	0·21631					
15	0·22857	0·19103	0·22085	0·21405	0·2010	0·1864	0·1452	0·0979	0·0014
20	0·22557	0·18760	0·21821	0·21155	0·1975	0·1813	0·1384	0·0908	−0·0044
25	0·22234	0·18398	0·21535	0·20881	0·1939	0·1765	0·1319	0·0838	−0·0103
30	0·21904	0·18015	0·21220	0·20567	0·1901	0·1717	0·1252	0·0768	−0·0164
35	0·21565	0·17618	0·20892	0·20246	0·1860	0·1668	0·1184	0·0693	−0·0226
40	0·21208	0·17202	0·20550	0·19910	0·1818	0·1620	0·1114	0·0618	−0·0293
45	0·20835	0·16780			0·1771	0·1563	0·1039	0·0539	−0·0361
50	0·20449	0·16341							
55	0·20056	0·15890							
60	0·19649	0·15420							
65		0·14936							
70	0·18782	0·14437							
75		0·13912							
80	0·1787	0·13394							
85		0·12838							
90	0·1695	0·12280							
95	0·1651								

°C	Ethanol		Iso-propanol		
	10%	20%	5%	10%	20%
0	0·22726	0·21606	0·23106	0·22543	0·21612
5			0·22892	0·22365	0·21492
10	0·22328	0·21367	0·22654	0·22158	0·21336
15			0·22390	0·21922	0·21138
20	0·21901	0·21013	0·22107	0·21667	0·20906
25	0·21467	0·20757	0·21807	0·21383	0·20637
30	0·21383	0·20587	0·21494	0·21081	0·20341
35			0·21164	0·20754	0·20009
40	0·20783	0·19962	0·20809	0·20410	0·19652

At 25°C		
Wt. %	Non-aqueous solvent	E_M° (volts)
100	Ethanol	−0·0740
3·06	Glycerol	0·2196
21·2		0·2084
5	Ethylene Glycol	0·21905
10		0·21635
15		0·21330
20		0·21020
30		0·20360
40		0·19720
60		0·18070
5	*d*-Glucose	0·21863
10		0·21419
15		0·2074
20		0·20451
25		0·1964
30		0·19355
32		0·1885
40		0·1788
50		0·1634
5	*d*-Fructose	0·21900
10		0·21502

°C	Dioxan				Glycerol	
	20%	45%	70%	82%	10%	30%
0	0·21975	0·18938	0·10584		0·23075	0·21684
5	0·21677	0·18468	0·09784	0·0025	0·22824	0·21421
10	0·21362	0·17972	0·08970	−0·0078	0·22557	0·21141
15	0·21025	0·17454	0·08123	−0·0185	0·22274	0·20851
20	0·20674	0·16916	0·07267	−0·0295	0·21970	0·20545
25	0·20303	0·16358	0·06395	−0·0415	0·21650	0·20221
30	0·19914	0·15778	0·05500	−0·0536	0·21315	0·19882
35	0·19505	0·15182	0·04587	−0·0658	0·20965	0·19521
40	0·19080	0·14560	0·03661	−0·0787	0·20600	0·19140
45	0·18634	0·13925	0·02705	−0·0925		
50	0·18171	0·13282	0·01746			

66 STANDARD E.M.F. ON MOLALITY SCALE FOR VARIOUS CELLS AT VARIOUS TEMPERATURES IN VOLTS

°C	A	B	C	D	E	F	G	H	I	J
0	0·08163		0·63495		1·67694				0·58151	
5	0·07991	0·14712	0·63097		1·67846			0·6176	0·58039	0·4250
10	0·07802	0·14805	0·62704		1·67998	0·99617		0·6161	0·57900	0·4248
15	0·07595	0·14920	0·62307		1·68159	0·99192		0·6145	0·57755	0·4243
20	0·07372	0·15062	0·61930	0·5443	1·68322	0·98849	0·83684	0·6126	0·57581	0·4236
25	0·07131	0·15225	0·61515	0·5392	1·68488	0·98485	0·83388	0·6105	0·57390	0·4227
30	0·06872	0·15396	0·61107	0·5351	1·68671	0·98103	0·83084	0·6083	0·57175	0·4215
35	0·06597	0·15586	0·60701	0·5318	1·68847	0·97702	0·82766	0·6059	0·56955	0·4201
40	0·06304	0·15787	0·60305		1·69036	0·97281	0·82430	0·6033	0·56730	0·4185
45	0·05995		0·59900		1·69231					
50	0·05667		0·59487		1·69436					
55			0·59051		1·69649					
60			0·58659		1·69861					

A	H_2|HBr in H_2O|AgBr, Ag
B	AgI, Ag|HI in H_2O|H_2
C	H_2|H_2SO_4 in H_2O|Hg_2SO_4, Hg
D	H_2|H_2SO_4 in MeOH|Hg_2SO_4, Hg
E	H_2|H_2SO_4 in H_2O|$PbSO_4$, PbO_2
F	Zn_xHg|$ZnCl_2$ in H_2O|AgCl, Ag
G	Zn_xHg|$ZnBr_2$ in H_2O|AgBr, Ag
H	Zn_xHg|ZnI_2 in H_2O|AgI, Ag
I	Cd_xHg|$CdCl_2$ in H_2O|AgCl, Ag
J	Cd_xHg|$CdBr_2$ in H_2O|AgBr, Ag

H_2|HBr in MeOH|AgBr, Ag	$E^\circ = -0·1328$ V at 25°C
H_2|HCl in H_2O|HgCl, Hg	$E^\circ = 0·26796$ V at 25°C
H_2|HBr in H_2O|HgBr, Hg	$E^\circ = 0·13956$ V at 25°C
H_2|HI in H_2O|HgI, Hg	$E^\circ = -0·0405$ V at 25°C

67 pH VALUES FOR STANDARD SOLUTIONS AT 25°C

A 0·05 M Potassium tetraoxalate	pH = 1·68
B Potassium hydrogen tartrate saturated at 25°C	pH = 3·56
C 0·05 M Potassium hydrogen phthalate	pH = 4·01
D 0·025 M Potassium dihydrogen phosphate + 0·025 M disodium hydrogen phosphate	pH = 6·86
E 0·01 M Sodium tetraborate (borax)	pH = 9·18
Subsidiary standards:	
0·025 M Sodium hydrogen succinate + 0·025 M sodium succinate	pH = 5·40
0·025 M Sodium bicarbonate + 0·025 M sodium carbonate	pH = 10·02
0·01 Trisodium phosphate	pH = 11·72
F 0·01 M Potassium hydrogen tartrate.	pH = 3·64

68 pH VALUES FOR STANDARD SOLUTIONS FROM 0°C TO 60°C

(for solutions see Table 67)

°C	A	B	F	C	D	E
0	1·671		3·710	4·012	6·983	9·463
5	1·671		3·690	4·005	6·950	9·389
10	1·669		3·671	4·001	6·922	9·328
15	1·674		3·655	4·000	6·896	9·273
20	1·676		3·647	4·001	6·878	9·223
25	1·681	3·555	3·637	4·005	6·860	9·177
30	1·685	3·547	3·633	4·011	6·849	9·135
35	1·693	3·545	3·629	4·019	6·842	9·100
40	1·697	3·543	3·630	4·030	6·837	9·066
45	1·704	3·545	3·634	4·043	6·834	9·037
50	1·712	3·549	3·640	4·059	6·833	9·012
55	1·719	3·556	3·646	4·077	6·836	8·987
60	1·726	3·565	3·654	4·097	6·840	8·961

Final digit depends on assumptions made about the activity coefficient of the chloride ion.

69 POTENTIAL OF ZERO CHARGE (E^{ecm}) FOR VARIOUS ELECTRODE MATERIALS IN AQUEOUS SOLUTIONS AT ROOM TEMPERATURE

(with respect to the normal hydrogen electrode)

Electrode	$E^{ecm}(V)$	Solution composition
Ag	+0·05	0·1 N KNO_3
Cd	−0·90	10^{-3} N KCl
Ga	−0·60	1 N KCl + 0·1 N HCl
Hg	−0·192	Capillary inactive salts
Ni	−0·06	10^{-3} N HCl
Pb	−0·69	10^{-3} N KCl
Platinized Pt	+0·11	1 N Na_2SO_4 + 0·1 N H_2SO_4
Smooth Pt	+0·27	1 N Na_2SO_4 + 0·1 N H_2SO_4
Oxidized Pt	+0·4 to +1·0	1 N Na_2SO_4 + 0·01 N H_2SO_4
Te	+0·61	1 N Na_2SO_4
Tl	−0·80	10^{-3} N KCl
Tl-Hg (sat)	−0·65	1 N KCl
Zn	−0·63	1 N Na_2SO_4
Graphite	−0·07	0·05 N KCl
Activated charcoal	0·0 to +0·2	1 N Na_2SO_4 + 1 N H_2SO_4

70 VISCOSITY OF METHANOLIC SALT SOLUTIONS

Constants for the equation $\eta/\eta_0 = 1 + A\sqrt{c} + Bc$ at 25°C

Salt	$A \times 10^4$	B	Salt	$A \times 10^4$	B
KBr	142	0·7396	KI	159	0·6747
KCl	151	0·7635	NH_4Cl	183	0·6610

71 VISCOSITY OF AQUEOUS SALT SOLUTIONS

Constants for the equations $\eta/\eta_0 = 1 + A\sqrt{c} + Bc$ and $\eta/\eta_0 = 1 + A\sqrt{c} + B^1c + C^1c^2$ at various temperatures

(η = viscosity of solution, η_0 that of the pure solvent)

Salt	t°C	$A \times 10^4$	B	c^1max	B^1	C^1	c^2max
$AgNO_3$	0	51·5	−0·03542	0·05	−0·03656	0·049844	0·5
	25	63	+0·04517	0·1	0·043805	0·017845	2·0
$BaCl_2$ [a]	25	−201·3	−0·20087	1·0			
CsI [a]	0	−25·3	+0·25368	0·1	0·25759	−0·02949	1·44
[a]	25	−38·7	+0·12250	0·2	0·12607	−0·01965	1·44
$CsNO_3$	25	43	−0·092	0·02			
HNO_3 [a]	18	−21	−0·0080	0·25			
[a]	35	−23	−0·0365	0·6			
KAc	25	38	0·238	0·09			
KBr	0	45	−0·15377	0·05	−0·15459	0·04244	0·5
	25	47·4			−0·04904	0·01221	2·0
$KBrO_3$	25	58	−0·0008	0·1			
KCl [a]	18	−52	0·0330	0·15			
	25	52	−0·0140	0·2	−0·01612	0·00808	3·0
[a]	35	−51	−0·0090	0·5			
$KClO_3$ [a]	18	−50	0·0560	0·07			
	25	50	−0·0309	0·1			
[a]	35	−49	0·0035	0·15			
K_2CrO_4	0	110·4	−0·01790	0·05	−0·023107	0·114591	0·5
	25	133·1	0·15210	0·1	0·148502	0·042218	0·5
$K_4Fe(CN)_6$	0	350·8	0·02768	0·02	0·02123	0·4778	0·2
	25	369·5	0·3660	0·1	0·33538	0·27832	0·5
$K_3Fe(CN)_6$	0	211·3	−0·1701	0·033	−0·18133	0·35368	0·17
	25	244	+0·1141	0·033	0·10785	0·13262	0·17
KI	25	41	0·088	0·1			
KIO_3	25	66	0·132	0·04			
$KMnO_4$ [a]	0	−47·2	0·17968	0·05	0·18268	−0·07094	0·18
[a]	25	−57·7	0·06600	0·125	0·06978	−0·04451	0·45
KNO_3	25	50	−0·0531	0·1			
K_2SO_4	0	121·6	0·03390	0·05	0·02798	0·12556	0·2
	25	140·6	0·19350	0·1	0·18951	0·033146	0·3
$LaCl_3$	0	278	0·47440	0·1	0·46276	0·14190	0·25
	18	(37)	(0·516)	0·006			
	25	304	0·5672	0·1	0·5551	0·14629	0·25
LiAc	25	66	0·397	0·06			
LiBr	25	79	0·106	0·07			
LiCl	25	64	0·139	0·2			
LiI	25	42	0·081	0·07			
$LiIO_3$	25	79	0·299	0·09			
LiPic	25	91	0·451	0·04			
$MgSO_4$	18	(66)	(0·808)	0·013			
NH_4Cl	25	57	−0·01439	0·2			
NaCl	0	44·8	0·02438	0·2	0·018923	0·025284	2·0
	25	67·0	0·07866	0·2	0·07620	0·01291	1·0
Na_2SO_4	25	155	0·357	2·0			
$RbNO_3$ [a]	18	−50	0·1120	0·02			
[a]	35	−56	0·0470	0·1			
Et_4NBr	25	82	0·343	0·02			
Et_4NPic	18	108	0·748	0·005			
	25	106	0·743	0·04			

[a] Data for the salts are for the equations $\eta_0/\eta = 1 + A\sqrt{c} + Bc$ and $\eta_0/\eta = 1 + A\sqrt{c} + B^1c + C^1c^2$.

c^1_{max} = maximum concentration to which the two-term equation is fitted.

c^2_{max} = maximum concentration to which the three-term equation is fitted.

72 DIFFERENTIAL DIFFUSION COEFFICIENTS FOR DILUTE AQUEOUS SOLUTIONS AT 25°C

D = Differential diffusion coefficient in cm² sec⁻¹

$AgNO_3$

$c \times 10^3$	$D \times 10^5$
0	1·768
2·85	1·718
3·22	1·719
4·27	1·711
4·96	1·708
6·28	1·701

$CaCl_2$

$c \times 10^3$	$D \times 10^5$
0	1·336
1·05	1·248
1·73	1·235
1·83	1·231
1·93	1·225
2·30	1·218
3·09	1·199
4·29	1·192
5·01	1·179

Cs_2SO_4

$c \times 10^3$	$D \times 10^5$
0	1·569
0·96	1·490
1·02	1·484
1·12	1·489
1·20	1·482
1·50	1·470
2·48	1·442
2·51	1·441
3·78	1·435
4·68	1·419
4·72	1·424

$K_4Fe(CN)_6$

$c \times 10^3$	$D \times 10^5$
0	1·473
2·69	1·218
3·84	1·197
3·96	1·198
4·74	1·183
5·56	1·178

KCl (4°C)

$c \times 10^3$	$D \times 10^5$
16·6	1·080
168	1·038
307	1·036
379	1·037
558	1·042

KCl (20°C)

$c \times 10^3$	$D \times 10^5$
0	1·765
1·25	1·736
2·48	1·725
3·67	1·719
4·51	1·709
11·21	1·689

KCl (25°C)

$c \times 10^3$	$D \times 10^5$
0	1·996
1·25	1·961
1·94	1·954
3·25	1·943
5·85	1·931
7·04	1·924
9·80	1·918
12·61	1·908
26·54	1·879
39·92	1·877
46·20	1·872
54·50	1·860
60·74	1·856
129·8	1·838
332·3	1·842
527·6	1·852

KCl (30°C)

$c \times 10^3$	$D \times 10^5$
0	2·233
3·26	2·172
6·50	2·154
8·96	2·146
12·36	2·139

KNO_3

$c \times 10^3$	$D \times 10^5$
0	1·931
0·904	1·902
1·21	1·894
1·63	1·887
2·21	1·891
2·59	1·873
2·68	1·878
4·03	1·869
4·52	1·868
5·03	1·877
5·15	1·857
5·38	1·872
6·00	1·868
7·28	1·856
8·68	1·847
9·19	1·855

CsCl

$c \times 10^3$	$D \times 10^5$
0	2·046
1·22	2·007
1·31	2·012
1·79	2·002
2·66	1·990
3·14	1·994
8·49	1·956
12·87	1·946

$MgCl_2$

$c \times 10^3$	$D \times 10^5$
0	1·251
1·29	1·187
1·53	1·180
2·05	1·168
2·70	1·164
2·83	1·157
3·09	1·157
3·64	1·155
4·00	1·164

NaCl

$c \times 10^3$	$D \times 10^5$
0	1·612
0·746	1·586
1·61	1·576
3·3	1·576
4·5	1·562
5·2	1·559
6·5	1·557
7·7	1·555
9·0	1·544
9·3	1·544
10·0	1·547
14·73	1·542

$BaCl_2$

$c \times 10^3$	$D \times 10^5$
0	1·387
0·68	1·332
0·97	1·319
1·09	1·321
1·39	1·308
2·14	1·302
2·87	1·285
4·03	1·265
4·52	1·271
5·42	1·261

$MgSO_4$

$c \times 10^3$	$D \times 10^5$
0	0·849
0·48	0·788
0·80	0·779
1·67	0·739
1·70	0·746
2·08	0·740
2·72	0·730
4·57	0·716
4·81	0·709
6·10	0·703
6·36	0·702

$LaCl_3$

$c \times 10^3$	$D \times 10^5$
0	1·294
0·93	1·178
1·16	1·162
1·27	1·163
1·40	1·159
1·95	1·146
2·40	1·135
2·72	1·126
3·07	1·127
3·38	1·120
4·01	1·110
5·52	1·104
6·68	1·087
26	1·021

LiCl

$c \times 10^3$	$D \times 10^5$
0	1·368
0·634	1·348
1·79	1·331
2·29	1·335
2·35	1·335
2·63	1·334
3·02	1·331
3·39	1·327
4·96	1·326
5·68	1·319
7·32	1·320
7·92	1·315
8·34	1·313
9·35	1·312
11·00	1·313

Li_2SO_4

$c \times 10^3$	$D \times 10^5$
0	1·041
0·64	1·000
0·71	0·997
0·71	0·998
0·85	0·993
2·10	0·973
2·67	0·968

Li_2SO_4

$c \times 10^3$	$D \times 10^5$
3·48	0·961
4·40	0·954
5·73	0·946

Na_2SO_4

$c \times 10^3$	$D \times 10^5$
0	1·230
0·81	1·178
0·81	1·177
1·47	1·170
1·99	1·160
2·68	1·151
3·56	1·137
4·48	1·129
4·49	1·132
4·79	1·124

RbCl

$c \times 10^3$	$D \times 10^5$
0	2·057
1·76	2·012
2·55	2·008
4·08	2·001
4·46	1·988
4·49	1·998
4·60	1·998
6·77	1·986
6·87	1·989
7·97	1·979
11·10	1·969

$SrCl_2$

$c \times 10^3$	$D \times 10^5$
0	1·336
1·08	1·270
1·50	1·256
2·50	1·243
2·72	1·244
3·00	1·233
3·00	1·237
4·45	1·222
5·49	1·212
6·11	1·217
7·74	1·208

Table 72 (*cont.*)

c	$D \times 10^5$ cm² sec⁻¹						
	$CaCl_2$	HBr	HCl	KBr	KCl	KI	LiBr
0	1.336	3·403	3·339	2·018	1·995	2·001	1·379
0·05	1·121	3·156	3·073	1·892	1·863	1·891	1·300
0·1	1·110	3·146	3·050	1·874	1·848	1·865	1·279
0·2	1·111	3·190	3·064	1·870	1·835	1·859	1·285
0·3	1·118	3·249	3·093	1·872	1·826	1·884	1·296
0·5	1·140	3·388	3·184	1·885	1·835	1·955	1·328
0·7	1·166	3·552	3·286	1·917	1·846	2·001	1·360
1·0	1·203	3·869	3·436	1·975	1·876	2·065	1·404
1·5	1·263		3·743	2·062	1·951	2·166	1·473
2·0	1·307		4·046	2·132	2·011	2·254	1·542
2·5	1·306		4·337	2·199	2·064	2·347	1·597
3·0	1·265		4·658	2·280	2·110	2·440	1·650
3·5	1·195		4·920	2·354	2·152	2·533	1·693
4·0			5·17	2·434			

c	$D \times 10^5$ cm² sec⁻¹						$(NH_4)_2SO_4$
	LiCl	NH_4Cl	NaBr	NaCl	NaI	$LiNO_3$	
0	1·368	1·996	1·627	1·612	1·616	1·337	1·527
0·05	1·280		1·533	1·506	1·527		0·802
0·1	1·269	1·838	1·517	1·484	1·520	1·240	0·852
0·2	1·267	1·836	1·507	1·478	1·532	1·243	0·867
0·3	1·269	1·841	1·515	1·477	1·547		
0·5	1·278	1·861	1·542	1·474	1·580	1·260	0·938
0·7	1·288	1·883	1·569	1·475	1·612		
1·0	1·302	1·921	1·596	1·483	1·662	1·293	1·011
1·5	1·331	1·986	1·629	1·495	1·751	1·317	1·047
2·0	1·363	2·051	1·668	1·514	1·846	1·332	1·069
2·5	1·397	2·113	1·702	1·529	8·925	1·336	1·088
3·0	1·430	2·164		1·544	1·992	1·332	1·106
3·5	1·464	2·203		1·559			
4·0		2·235		1·584		1·292	1·125
4·5		2·257		1·607			at 3·6

73 IONIC DIFFUSION COEFFICIENTS (cm² sec⁻¹) AND ACTIVATION ENERGIES FOR DIFFUSION (in kcal mole⁻¹) FOR THE INFINITELY DILUTE AQUEOUS SOLUTION

(from the Nernst equation)

Ion	$D \times 10^5$	E	Ion	$D \times 10^5$	E	Ion	$D \times 10^5$	E	Ion	$D \times 10^5$	E
Cd^{2+}	0·72		Na^+	1·35	4·39	Br^-	2·08	4·07	I^-	2·05	4·05
Cs^+	2·11	3·86	Ni^{2+}	0·69		BrO_3^-	1·44		IO_3^-	1·09	
Cu^{2+}	0·72		Pb^{2+}	0·98		CH_3COO^-	1·09		NO_3^-	1·92	
H^+	9·34		Rb^+	2·07	3·95	Cl^-	2·03	4·17	OH^-	5·23	
K^+	1·98	3·99	Tl^+	2·00		CrO_4^{2-}	1·07		SO_4^{2-}	1·08	
Li^+	1·04	4·56	Zn^{2+}	0·72		$Fe(CN)_6^{3-}$	0·89				
						$Fe(CN)_6^{4-}$	0·74				

74 DIFFERENTIAL SELF-DIFFUSION COEFFICIENTS OF IONS IN AQUEOUS SOLUTIONS OF SALTS AT 25°C

c NaCl	$D\times10^5$ (Na^+)	$D\times10^5$ (Cl^-)	Molality NaI	$D\times10^5$ (Na^+)	$D\times10^5$ (I^-)	c KI	$D\times10^5$ (K^+)	$D\times10^5$ (I^-)
0·005	1·32		$10^{-4}-10^{-5}$	1·445		0·010		2·020
0·01	1·31		$5\times10^{-4}-10^{-3}$		2·035	0·048		2·001
0·03		1·975	0·01	1·31	1·962	0·050	1·970	
0·05	1·30	1·96	0·02	1·284	1·900	0·100	2·005	1·985
0·100	1·31	1·94	0·03	1·288		0·200		1·975
0·175	1·313		0·05	1·283	1·88	0·290	2·060	
0·200	1·32		0·07	1·282	1·87	0·300		1·965
0·250		1·91	0·10	1·274	1·87	0·500	2·030	1·955
0·300	1·35		0·20	1·275	1·851	0·774	2·080	
0·350	1·34		0·30	1·275	1·84	1·000	2·030	1·941
0·500	1·32	1·85	0·50		1·81	1·440		1·920
0·625	1·31		0·70	1·270		1·960	1·910	
1·000	1·25	1·77	1·00	1·264	1·735	2·000		1·891
2·000	1·13	1·61	1·50	1·249	1·67	3·000		1·842
3·000	1·02	1·44	2·00	1·24	1·63	3·062	1·850	
4·000	0·904	1·24	2·50		1·60			
5·000	0·796	1·06	3·50	1·239	1·567			

c $CaCl_2$	$D\times10^5$ Ca^{2+}	$D\times10^5$ Cl^-	c HI	$D\times10^5$ (I^-)	c LiI	$D\times10^5$ (I^-)	c NaH_2PO_4	$D\times10^5$ ^{32}P
0·010	0·778		0·050	2·011	0·061	2·004	0·0000987	0·874
0·071	0·782	1·89	0·100	2·013	0·125	1·991	0·000503	0·833
0·282	0·767	1·72	0·145	2·003	0·237	1·910	0·00103	0·868
0·803	0·646	1·60	0·290	1·970	0·500	1·847	0·00488	0·830
1·41	0·560	1·42	0·806	1·903	0·760	1·795	0·0102	0·791
2·68	0·405	0·907	1·075	1·877	1·134	1·694	0·0493	0·778
4·02	0·225	0·447	2·210	1·780	2·000	1·540	0·0991	0·767
5·36	0·100	0·159	3·320	1·705	3·340	1·268	0·506	0·703
			4·040	1·643	4·100	1·220	1·006	0·519

c RbI	$D\times10^5$ (Rb^+)	$D\times10^5$ (I^-)
0·010	2·055	2·035
0·038	2·047	
0·040		1·990
0·070	2·037	
0·100		1·990
0·110	2·017	
0·185	2·008	
0·250		1·976
0·370	2·004	
0·510		1·919
0·640	1·995	
0·850		1·860
0·927	1·993	
1·255		1·840
1·308		1·824

75 INTEGRAL DIFFUSION COEFFICIENTS FOR AQUEOUS KCl AT 25°C

c	$\bar{D}^\circ\times10^5$	c	$\bar{D}^\circ\times10^5$
0	1·996	0·3	1·850
0·001	1·974	0·5	1·848
0·002	1·966	0·7	1·851
0·003	1·960	1·0	1·859
0·005	1·951	1·2	1·866
0·007	1·945	1·4	1·874
0·01	1·938	1·6	1·882
0·02	1·920	1·8	1·892
0·03	1·908	2·0	1·901
0·05	1·893	2·5	1·927
0·07	1·883	3·0	1·953
0·1	1·873	3·5	1·979
0·2	1·857	3·9	2·000

$\bar{D}^0$ = integral diffusion coefficient in cm^2 sec^{-1};

$\bar{D}^0=\dfrac{1}{c}\displaystyle\int_0^c D\,\mathrm{d}c.$ c = concentration in moles l^{-1}.

76 CONDUCTANCE IN DILUTE AQUEOUS SOLUTIONS

Constants for the equation $\Lambda=\Lambda_0(1-a\sqrt{c}+bc)$ ohm^{-1} cm^2 where Λ = equivalent conductivity at concentration c (mole l^{-1})[a].

0°C

	Λ_0	a	b		Λ_0	a	b		Λ_0	a	b
$AgNO_3$	72	0·63	0·3	KBr	83·4	0·58	0·65	$NaNO_3$	66·5	0·66	0·32
$\frac{1}{3}AlBr_3$	69·6	1·57	2·5	$KBrO_3$	71·0	0·63	0·2	NaPic	41·3	0·94	1·9
$\frac{1}{3}AlCl_3$	70·4	1·57	2·1	KCl	81·7	0·58	0·60	$\frac{1}{2}Na_2SO_4$	66·4	1·34	1·5
$\frac{1}{3}AlI_3$	72	1·53	2·3	$KClO_4$	76·4	0·61	0·15	$\frac{1}{3}NdCl_3$	70	1·68	6
$\frac{1}{2}BaAc_2$	52·5	1·53	1·7	KI	82·9	0·58	0·69	$\frac{1}{2}NiAc_2$	45·6	1·77	1·4
$\frac{1}{2}BaCl_2$	74·5	1·19	1·5	KIO_3	61·0	0·70	0·40	$\frac{1}{2}Ni(NO_3)_2$	63·2	1·32	1·7
$\frac{1}{2}BaI_2$	75	1·19	2·1	KNO_3	79·8	0·59	0·29	$\frac{1}{2}Pb(NO_3)_2$	72·5	1·29	0·8
$\frac{1}{2}Ba(NO_3)_2$	72	1·22	0·7	KPic	55·6	0·75	0·8	RbI	82·3	0·58	0·5
$\frac{1}{2}CaCl_2$	72·0	1·22	1·50	$\frac{1}{2}K_2SO_4$	81·0	1·16	1·0	$\frac{1}{3}SmBr_3$	75·6	1·5	2·2
$\frac{1}{4}Ca_2Fe(CN)_6$	60	5·55	11	$\frac{1}{3}LaCl_3$	72	1·56	2·7	$\frac{1}{3}SmCl_3$	72·7	1·55	2·3
$\frac{1}{2}CaI_2$	70·6	1·24	2·8	$\frac{1}{3}La(NO_3)_3$	72	1·56	1·8	$\frac{1}{3}SmI_3$	75·3	1·51	2·3
$\frac{1}{2}Ca(NO_3)_2$	70·7	1·24	1·2	LiCl	60·5	0·71	0·64	$\frac{1}{2}SrCl_2$	75	1·19	1·4
$\frac{1}{2}CdI_2$	36·3	2·06	1·52	$LiClO_4$	55·0	0·75	2·0	$\frac{1}{4}Sr_2Fe(CN)_6$	60	5·53	13
$\frac{1}{2}CdSO_4$	56	2·72	3	$\frac{1}{2}Li_2CrO_4$	64·4	1·39	1·4	$\frac{1}{2}Sr(NO_3)_2$	70·4	1·24	0·9
$\frac{1}{2}CrSO_4$	63	3·84	0·6	LiI	61·9	0·69	0·9	$\frac{1}{3}YBr_3$	75·5	1·51	2·1
CsCl	84·3	0·57	0·47	$LiNO_3$	57·0	0·74	0·64	$\frac{1}{3}YCl_3$	70·7	1·57	2·8
CsI	86·3	0·56	0·57	LiPic	34·6	1·07	2·4	$\frac{1}{3}YI_3$	74·9	1·52	2·3
$CsNO_3$	82·8	0·58	0·26	$\frac{1}{2}Li_2SO_4$	60·7	1·44	1·4	$\frac{1}{3}YbBr_3$	73	1·65	3·4
$\frac{1}{2}CuAc_2$	32·4	2·19	1·8	$\frac{1}{2}MgCl_2$	74·2	1·20	1·20	$\frac{1}{3}YbCl_3$	71	1·67	3·4
$\frac{1}{2}CuCl_2$	68·6	1·26	1·7	$\frac{1}{2}Mg(NO_3)_2$	69·0	1·26	1·30	$\frac{1}{2}Zn(NO_3)_2$	67·2	1·28	2·0
$\frac{1}{2}Cu(NO_3)_2$	69	1·26	1·5	$\frac{1}{2}MgSO_4$	60·3	2·63	3·1	$\frac{1}{2}ZnSO_4$	55	2·75	4
$\frac{1}{2}CuSO_4$	52	2·84	4·5	$\frac{1}{2}MnCl_2$	64·9	1·29	1·6	Me_4NCl	65·2	0·67	−0·74
$\frac{1}{3}ErCl_3$	69	1·70	6·5	NH_4CNS	77·1	0·60	0·60	Me_4NI	65·6	0·67	−1·1
$\frac{1}{3}ErI_3$	71	1·56	5	NH_4Cl	81·4	0·58	0·61	Me_4NPic	38·18	0·99	1·4
$\frac{1}{3}GdBr_3$	74·9	1·52	2·2	NH_4Ac	62·6	0·69	0·4	Et_4NCl	56·9	0·74	0·14
$\frac{1}{3}GdCl_3$	73·1	1·54	2·3	NH_4IO_3	60·6	0·71	0·4	Et_4NI	58·4	0·73	−1·5
$\frac{1}{3}GdI_3$	74·8	1·52	2·7	NH_4Pic	55·1	0·76	1·2	Et_4NPic	31·1	1·17	2·5
HCl	265	0·33	0·4	$NaBrO_3$	56	0·74	0·5	Pr_4NCl	52·4	0·78	−2·0
HIO_3	245	0·34	−5	NaCNS	62·7	0·69	0·68	Pr_4NI	53·0	0·77	−1·9
HNO_3	260	0·33	0·7	NaCl	66·9	0·68	0·77	Bu_4NCl	50·9	0·80	−0·7
HPic	238·5	0·34	−0·9	$\frac{1}{2}Na_2CrO_4$	69	1·31	1·3	Bu_4NI	51·2	0·79	−2·3

[a] This equation has been fitted to experimental results in the medium concentration region (c = 0·001 to 0·1). Satisfactory values for Λ may therefore be calculated for this region, but errors may be introduced outside it. In particular Λ_0 may not agree with the best values obtained from measurements in very dilute solution. These are best obtained from Tables 79 and 80.

25°C

	Λ_0	a	b		Λ_0	a	b		Λ_0	a	b
$AgMnO_4$	122	0·72	2	$\frac{1}{2}CaCl_2$	135·6	1·3	1·8	$\frac{1}{2}CuAc_2$	60	2·36	2·2
$AgNO_3$	133·3	0·68	0·35	$\frac{1}{4}Ca_2Fe(CN)_6$	118	5·47	11	$\frac{1}{2}CuBr_2$	134	1·31	1·6
$\frac{1}{2}Ag_2SO_4$	142	1·30	−3·5	$\frac{1}{6}Ca_3[Fe(CN)_6]_2$	138	3·87	7·2	$\frac{1}{2}CuCl_2$	131	1·33	1·5
$\frac{1}{3}AlBr$	139	1·64	2·2	$\frac{1}{2}Ca(NO_3)_2$	130·0	1·35	2·0	$\frac{1}{2}Cu(NO_3)_2$	128·8	1·38	1·7
$\frac{1}{3}AlCl_3$	137·6	1·65	2·0	$\frac{1}{2}CaSO_4$	104	2·9	3·6	$\frac{1}{2}CuSO_4$	113	2·79	3·3
$\frac{1}{3}AlI_3$	137·6	1·66	3·1	$\frac{1}{2}CdBr_2$	97	1·73	0·95	$\frac{1}{2}FeCl_2$	137	1·34	1·05
$\frac{1}{3}Al(NO_3)_3$	129·5	1·72	2·2	$\frac{1}{2}CdCl_2$	104	1·65	0·9	$\frac{1}{2}FeSO_4$	99	2·08	1·7
$\frac{1}{2}BaAc_2$	104·2	1·59	1·7	$\frac{1}{2}CdI_2$	77	2·02	1·38	$\frac{1}{3}GdBr_3$	139·9	1·63	3·2
$\frac{1}{2}BaBr_2$	141·1	1·28	1·78	$\frac{1}{2}CdSO_4$	105	2·89	3·7	$\frac{1}{3}GdCl_3$	140	1·63	2·5
$\frac{1}{2}Ba(BrO_3)_2$	118	1·44	1·4	$\frac{1}{2}CoAc_2$	90·1	1·74	1·4	$\frac{1}{3}GdI_3$	139	1·64	4·0
$\frac{1}{2}BaCl_2$	139·5	1·28	1·74	$\frac{1}{2}CoBr_2$	126	1·35	1·9	HBr	429·4	0·37	0·35
$\frac{1}{2}BaI_2$	141	1·28	2·7	$\frac{1}{2}CoCl_2$	124·5	1·37	1·2	$HBrO_3$	408	0·37	−5
$\frac{1}{2}Ba(MnO_4)_2$	119	1·42	1·4	$\frac{1}{2}Co(NO_3)_2$	122·4	1·39	2·0	HCNS	404	0·38	0·37
$\frac{1}{2}Ba(NO_3)_2$	132	1·34	1·2	$\frac{1}{2}CoSO_4$	100	2·07	1·65	HCl	426·0	0·37	0·38
$\frac{1}{2}Ba(OH)_2$	256	0·88	0·6	CsCl	154·6	0·62	−0·7	$HClO_3$	408	0·36	0·4
$\frac{1}{2}CaBr_2$	133·0	1·32	2·1	CsOH	271	0·45	0·5	$HClO_4$	417	0·37	0·4

Table 76 (cont.)

25°C											
	Λ_0	*a*	*b*		Λ_0	*a*	*b*		Λ_0	*a*	*b*
$\frac{1}{2}H_2CrO_4$	207	0·97	2·2	$\frac{1}{2}Mg(NO_3)_2$	129·0	1·35	1·8	$\frac{1}{2}NiCl_2$	123·3	1·37	1·7
HI	428	0·37	0·42	$\frac{1}{2}Mg(OH)_2$	257	0·87	2·1	$\frac{1}{2}Ni(NO_3)_2$	124·5	1·37	1·8
HIO_3	391·2	0·38	−4·7	$\frac{1}{2}MgSO_4$	116	2·75	3·7	$\frac{1}{2}NiSO_4$	100	2·7	1·6
$HMnO_4$	410	0·38	0·2	$\frac{1}{2}MnBr_2$	128	1·34	1·7	$\frac{1}{2}PbCl_2$	145·0	1·26	−7
HNO_3	420	0·37	0·36	$\frac{1}{2}MnCl_2$	126	1·36	1·6	$\frac{1}{2}Pb(NO_3)_2$	135·7	1·32	0·89
KAc	115·4	0·75	1·3	$\frac{1}{2}MnSO_4$	109	2·84	3·8	RbBr	148	0·63	0·2
KBr	151·7	0·62	0·62	NH_4Br	155	0·62	0·60	RbCl	153	0·62	0·7
$KBrO_3$	129·4	0·69	0·48	NH_4CNS	140·8	0·65	0·5	RbI	145·3	0·64	0·65
KCNS	140·0	0·65	0·63	NH_4Cl	150·5	0·63	0·49	RbOH	272	0·45	0·5
KCl	149·8	0·63	0·64	NH_4IO_3	117	0·74	0	$\frac{1}{3}SmBr_3$	140·2	1·63	2·9
$KClO_3$	138·7	0·66	0·4	NH_4NO_3	145·3	0·64	0·55	$\frac{1}{3}SmCl_3$	139·8	1·64	3·0
$\frac{1}{2}K_2CrO_4$	156	1·22	1·3	NH_4Pic	104·4	0·80	0·9	$\frac{1}{3}SmI_3$	138·5	1·64	3·4
KF	128	0·70	0·5	$\frac{1}{2}(NH_4)_2SO_4$	149·9	1·25	1·1	$\frac{1}{2}SrAc_2$	101	1·63	2·0
$\frac{1}{4}K_4Fe(CN)_6$	169	2·48	3·6	NaAc	91·1	0·89	0·34	$\frac{1}{2}SrBr_2$	136·0	1·30	1·8
$\frac{1}{3}K_3Fe(CN)_6$	167·8	1·56	1·8	NaBr	126·0	0·70	0·5	$\frac{1}{2}SrCl_2$	136·0	1·30	1·74
$\frac{1}{2}K_2Fe(CN)_5NO$	136·4	1·32	1·9	$NaBrO_3$	106·1	0·79	0·60	$\frac{1}{2}Sr(NO_3)_2$	131·8	1·34	1·5
KI	150·8	0·63	0·62	NaCNS	110·5	0·77	0·75	TlCl	150·3	0·63	−1·3
KIO_3	115	0·53	0·4	$\frac{1}{2}Na_2CO_3$	124·1	1·47	1·6	$TlClO_3$	137·6	0·65	0·45
$KMnO_4$	136	0·67	0·5	NaCl	126·5	0·70	0·74	TlOH	276·1	0·45	0·45
KNO_3	144·5	0·64	0·36	$NaClO_3$	115	0·75	0·6	$\frac{1}{3}YBr_3$	141	1·63	2·8
KOH	271	0·45	0·4	$NaClO_4$	110	0·77	0·6	$\frac{1}{3}YCl_3$	136	1·67	3·5
$\frac{1}{2}K_2SO_4$	151·4	1·24	1·14	$\frac{1}{2}NaCrO_4$	132	1·38	1·5	$\frac{1}{3}YI_3$	143·8	1·60	2·6
LiBr	121·4	0·72	0·5	NaF	106	0·79	0·6	$\frac{1}{2}ZnAc_2$	88	1·77	1·2
LiCl	115	0·75	0·78	$\frac{1}{4}Na_4Fe(CN)_6$	155	2·74	4·7	$\frac{1}{2}ZnBr_2$	159	1·23	0·7
$LiClO_3$	104·1	0·81	0·3	$NaHCO_3$	96·0	0·85	0·6	$\frac{1}{2}ZnCl_2$	130	1·48	2·3
$\frac{1}{2}Li_2CrO_4$	123·6	1·46	1·5	NaI	127·0	0·70	0·80	$\frac{1}{2}Zn(NO_3)_2$	125	1·37	2·2
LiI	117·7	0·74	0·8	$NaNO_3$	123	0·72	0·36	$\frac{1}{2}ZnSO_4$	105	2·90	4·2
$LiNO_3$	111	0·77	0·45	NaOH	246·5	0·47	0·3	Me_3HNCl	123·6	0·71	0·76
LiOH	236·5	0·48	0·5	NaPic	81	0·97	0·7	Me_4NI	118·6	0·73	0·35
$\frac{1}{2}Li_2SO_4$	119·2	1·48	1·4	$\frac{1}{2}Na_2SO_4$	129·0	1·39	1·50	Me_4NPic	76	1·02	0·5
$\frac{1}{2}MgBr_2$	129	1·34	2·2	$\frac{1}{2}Na_2S_2O_3$	135·0	1·36	1·60	Et_4NI	108	0·78	—
$\frac{1}{2}MgCrO_4$	125	2·64	3·2	$\frac{1}{2}NiAc_2$	89·5	1·75	1·3	Et_4NPic	63	1·18	—
$\frac{1}{4}Mg_2Fe(CN)_6$	172	4·75	13	$\frac{1}{2}NiBr_2$	127	1·34	1·6	Pr_4NI	100	0·83	—

100°C											
	Λ_0	*a*	*b*		Λ_0	*a*	*b*		Λ_0	*a*	*b*
$\frac{1}{2}Ba(NO_3)_2$	371·4	1·55	1·6	KNO_3	383·3	0·77	0·50	$NaNO_3$	339·3	0·84	0·6
$\frac{1}{2}Ba(OH)_2$	606	1·11	0·8	KPic	290·4	0·93	1·2	NaOH	597·3	0·58	1·0
HCl	843·6	0·49	0·4	$\frac{1}{3}La(NO_3)_3$	390	1·94	2·1	Et_4NPic	196·8	1·25	0·7
HNO_3	823	0·49	0·40	$LiClO_4$	296·5	0·92	1·2				
KCl	405·8	0·74	0·4	LiPic	291	0·93	1·05				
$KClO_4$	376·1	0·76	0·3	$\frac{1}{2}MgSO_4$	304	3·21	4·4				
$\frac{1}{4}K_4Fe(CN)_6$	465	2·98	5·1	NaCl	361	0·8	−0·78				

77 SPECIFIC CONDUCTIVITY OF STANDARD AQUEOUS POTASSIUM CHLORIDE SOLUTIONS IN $ohm^{-1}\,cm^{-1}$

0°C	18°C	20°C	25°C
1 N KCl, 71·3828 g KCl per kg of solution in vacuum			
$0{\cdot}06543_0$	$0{\cdot}09820_1$	$0{\cdot}10202_4$	$0{\cdot}11173_3$
0·1 N KCl, 7·43344 g KCl per kg of solution in vacuum			
$0{\cdot}007154_3$	$0{\cdot}011191_9$	$0{\cdot}011667_6$	$0{\cdot}012886_2$
0·01 N KCl 0·746558 g KCl per kg of solution in vacuum			
$0{\cdot}0007751_2$	$0{\cdot}0012226_9$	$0{\cdot}0012757_2$	$0{\cdot}0014114_5$

78 CONDUCTANCE IN DILUTE NON-AQUEOUS SOLUTIONS

Constants for the equation $\Lambda=\Lambda_0(1-a\sqrt{c}+bc)$ $ohm^{-1}\,cm^2$ where Λ = equivalent conductivity at concentration *c* ($mole\ l^{-1}$)[a].

METHANOL AT 25°C			
Solute	Λ_0	*a*	*b*
HBr	192	1·78	2
HCl	188	1·79	2·0
HI	197	1·76	2·5
$KCH_3(CH_2)_3COO$	89	2·73	4·1
KI	113·3	2·34	5·1
KOH	105·8	2·45	5·5
$KOCH_3$	106·8	2·42	1
LiCNS	101·5	2·51	5·5
LiCl	94·2	2·53	3
$LiNO_3$	100·7	2·52	5
NaBr	101·8	2·5	4·1
NaCNS	106·9	2·43	6
$NaCH_3(CH_2)_3COO$	82	2·88	4·1
$NaC_6HCH_3(NO_2)_3O$	91	2·67	3·9
NaCl	98·4	2·56	4·0
NaI	107·8	2·42	4·8
NaOH	95·7	2·6	5·6
$NaOCH_3$	98·4	2·55	5
NaPic	91·4	2·68	4·6
Et_4NI	117·6	2·3	2
Me_3NCH_2PhI	96·8	2·58	5·0
$(C_5H_{11})_4NI$	86·9	2·77	4
$(C_3H_5)_2H_2NPic$	102·4	2·49	2
$i\text{-}C_4H_9H_3NCl$	97·4	2·57	6
$C_5H_{12}NC_6HMe(NO_2)_3O$	94·4	2·63	2·8
$PhH_3NC_6HMe(NO_2)_3O$	82	2·88	3·8

ETHANOL AT 25°C			
Solute	Λ_0	*a*	*b*
HBr	77·3	2·62	4·1
HCl	70·5	2·74	3·6
HI	81·4	2·57	4·5
KI	46·5	3·42	6·4
KOH	42	3·63	6·0
LiCl	37·4	3·90	7·0
$LiNO_3$	40·7	3·70	6·8
NH_4CCl_3COO	37	3·93	6·2
NH_4Cl	39·7	3·75	6·2
NH_4Pic	40·8	3·7	6
NaBr	39	3·80	10
$NaCCl_3COO$	34·3	4·12	6·6
NaI	46	3·44	7
NaOH	38	3·86	6·8
Me_3NCH_2PhI	43·4	3·56	5·8
$C_5H_{12}NCl$	37·0	3·92	6·0
$C_5H_{12}NPic$	37·5	3·90	5·6
$CPh_2(p\text{-}C_6H_4OMe)ClO_4$	61·4	3·02	6
$CPh(p\text{-}C_6H_4OMe)_2ClO_4$	60·3	2·97	7

ACETONE AT 25°C			
Solute	Λ_0	*a*	*b*
NaI	161	3·71	6
Pr_4NI	152	3·83	6
$C_5H_{12}NPic$	89·1	5·34	9
$CPh_2(p\text{-}C_6H_4OMe)ClO_4$	160	3·72	5
$C(p\text{-}C_6H_4OMe)_3ClO_4$	160·2	3·72	8

ACETONITRIDE AT 25°C			
Solute	Λ_0	*a*	*b*
$AgNO_3$	150	2·28	1·4
KI	181·4	2·02	1·5
$\frac{1}{3}TlBr_3$	140·5	2·39	5·9
$\frac{1}{3}TlCl_3$	170·4	2·09	2·1
Pr_4NClO_4	172·3	2·08	2·4
Pr_4NI	169·6	2·10	10
Pr_4NPic	146·3	2·32	14
Am_4NI	152	2·26	1
$CPh_2(p\text{-}C_6H_4OMe)ClO_4$	160·9	2·18	4
$C(p\text{-}C_6H_4OMe)_3ClO_4$	156·7	2·22	5

[a] See note to Table 64.

HYDROGEN CYANIDE AT 18°C

Valid to $c=10^{-5}N$. $\Lambda=\Lambda_0-A\sqrt{c}$ $ohm^{-1}\,cm^2$

Solute	Λ_0	*A*	Solute	Λ_0	*A*	Solute	Λ_0	*A*
CsCl	368·2	200	LiBr	346·9	270	NaCNS	337·7	230
KBr	363·2	248	LiCNS	340·6	400	$NaClO_4$	335·5	235
KCNS	358·0	243	LiCl	345·4	335	NaI	344·9	238
KCl	363·4	280	$LiClO_4$	336·9	230	$NaNO_3$	333·8	250
$KClO_4$	353·3	275	LiI	348·0	258	NaPic	266·9	195
KI	363·3	235	$LiNO_3$	336·6	402	RbCl	363·2	195
KNO_3	353·9	253	NaBr	343·8	243	Et_4NPic	282·3	215

Table 78 (*cont.*)

SULPHUR DIOXIDE AT 0°C			
Solute	Λ_0	a	b
Ph_3CClO_4	153·6	5·03	17
$Ph_2C(C_6H_4Me)ClO_4$	149·8	4·93	15
$PhC(C_6H_4Me)_2ClO_4$	141·3	5·06	16
$C(C_6H_4Me)_3Cl$	168·5	4·69	15
$C(C_6H_4Me)_3ClO_4$	150	4·92	15
$Ph_2C(C_6H_4Ph)Cl$	78·3	6·83	16
$C(C_6H_4Ph)_3Cl$	145·6	5·0	12
$Ph_2C(p\text{-}C_6H_4OMe)Cl$	169·1	4·68	13
$Ph_2C(p\text{-}C_6H_4OMe)ClO_4$	148	4·95	17
$C(p\text{-}C_6H_4OMe)_3ClO_4$	144·4	5·03	16
$PhC(p\text{-}C_6H_4NO_2)(p\text{-}C_6H_4OMe)Cl$	90	5·97	20
$C(p\text{-}C_6H_4NO_2)_2(p\text{-}C_6H_4OMe)ClO_4$	103·5	5·86	17
$C(p\text{-}C_6H_4NO_2)(p\text{-}C_6H_4OMe)_2ClO_4$	123	5·39	20
Me_4NCl	160·5	4·8	11·8
Me_4NBr	160·8	4·79	11·8
Me_4NI	166	4·72	12
Me_3SI	150·2	4·93	12

FORMAMIDE AT 25°C			
Solute	Λ_0	a	b
$\frac{1}{2}Ba(NO_3)_2$	30·3	1·33	1·3
$\frac{1}{2}Ca(NO_3)_2$	31·6	1·29	1·0
$CsCl$	29	0·74	0·75
$CsNO_3$	29·4	0·74	0·61
$KCNS$	28·7	0·75	1·2
KCl	28	0·76	0·9
KI	27·7	0·77	1·04
$LiNO_3$	25	0·83	1·05
NH_4Cl	30·4	0·72	1·6
NH_4I	30·5	0·72	1·1
NH_4NO_3	33·6	0·67	0·6
$NaBr$	25·7	0·81	0·8
$\frac{1}{2}Na_2CrO_4$	26	1·56	1·8
NaI	25	0·83	1·18
$NaNO_3$	28·3	0·76	0·63
$NaHCOO$	25·1	0·83	0·65
$NaPhCOO$	20	0·99	0·78
NaSalicylate	20·6	0·97	0·6
$NaPhSO_3$	20·7	0·96	0·75
$RbBr$	28·3	0·76	1·1
$RbCl$	28·2	0·76	0·6
RbI	28	0·76	1·0
$RbNO_3$	28·6	0·75	1·0
$\frac{1}{2}Sr(NO_3)_2$	32	1·28	1·0
Me_4NCl	28·7	0·75	0·65
Me_4NI	25·0	0·83	1·1
Et_4NCl	28·7	0·75	0·65
Et_4NI	25·0	0·83	1·1

AMMONIA AT −33°C			
Solute	Λ_0	a	b
$AgNO_3$	241·7	3·92	8
HCl	183·8	4·48	9
HNO_3	245·5	3·89	7·3
KI	295·7	3·59	6
KNH_2	108·7	6·55	13
KPh_2N	230	4·01	8
KPh_3BNH_2	155	5·14	10·5
$LiNO_3$	225·7	4·05	8·5
$NaBr$	240·2	3·92	7
$NaCl$	206·9	4·22	8
NaI	265·1	3·76	7·2
$NaNO_3$	224·8	4·05	8
$NaEtS$	201·8	4·27	9
$NaPhS$	219·6	4·32	10
$NaPh_2N$	198·7	4·3	10
$NaMe_3Sn$	249	3·86	10
$NaPh_3BNH_2$	202·5	4·26	9·8
Et_2HNCl	188	4·43	8
Me_3SI	210	4·19	6·9

DIMETHYL-
FORMAMIDE
AT 25° C

Constants for $\Lambda = \Lambda_0 - A\sqrt{c}$ ohm^{-1} cm^2. Valid to $c = 2 \times 10^{-3}$.

Solute	Λ_0	A
KBr	84·1	154
$KCNS$	90·2	151
$KClO_4$	82·7	137
KI	82·6	137
KNO_3	88·5	214
$NaBr$	83·4	165
$NaCNS$	89·5	171
$NaClO_4$	82·1	145
NaI	81·9	138
$NaNO_3$	87·9	263

HYDRAZINE AT 0°C			
Solute	Λ_0	a	b
$\frac{1}{2}CdI_2$	76	1·97	2·2
HCl	103	0·858	0·7
$HPhCOO$	85·9	0·950	—
HPh_3CCOO	74·8	1·03	−4
HCH_2NO_3	87	0·94	−3
$Hm\text{-}C_6H_4(NO_2)O$	86·4	0·95	−5
KCl	85	0·96	1·0
$Nam\text{-}C_6H_4(NO_2)O$	58·1	1·21	4
Et_4NI	66·6	0·87	−1·0
25°C HCl	153·9	0·90	0·6
$KClO_4$	128·2	0·99	1·3
KI	130	0·99	1·2
$NaClO_4$	110	1·09	1·4
NaI	112·5	1·07	0·8
Et_4NCl	99·7	1·16	1·6

FORMIC ACID AT 25°C							
Solute	Λ_0	a	b	Solute	Λ_0	a	b
$CsHCOO$	75·2	1·06	1·4	$RbHCOO$	81·1	1·02	1
$KHCOO$	79·6	1·03	1·5	$PhNH_3HCOO$	75·8	1·06	1·2
$LiHCOO$	75·7	1·06	0·7	8·50°C KCl	35·82	1·12	0·94
NH_4HCOO	82·4	1·01	1·2	Me_4NCl	35·70	1·12	0·94
$NaHCOO$	75·7	1·06	1·4				

79 LIMITING IONIC MOBILITIES (λ°) IN AQUEOUS SOLUTION

(ohm^{-1} cm^2)

CATIONS AT 25°C

Ion	λ°	Ion	λ°	Ion	λ°
Ag^+	61·92	$\frac{1}{2}Fe^{2+}$	53·5	Tl^+	74·7
$\frac{1}{3}Al^{3+}$	63	$\frac{1}{3}Fe^{3+}$	68	$\frac{1}{3}Tm^{3+}$	65·4
$\frac{1}{2}Ba^{2+}$	63·64	$\frac{1}{3}Gd^{3+}$	67·4	$\frac{1}{2}UO_2^{2+}$	51
$\frac{1}{2}Be^{2+}$	45	$\frac{1}{2}Hg_2^{2+}$	68·6	$\frac{1}{3}Y^{3+}$	63
$\frac{1}{2}Ca^{2+}$	59·50	$\frac{1}{2}Hg^{2+}$	63·6	$\frac{1}{3}Yb^{3+}$	65·1
$\frac{1}{2}Cd^{2+}$	54·0	$\frac{1}{3}Ho^{3+}$	66·2	$\frac{1}{2}Zn^{2+}$	52·8
$\frac{1}{3}Ce^{3+}$	69·8	$\frac{1}{3}La^{3+}$	69·61	Me_4N^+	44·92
$\frac{1}{2}Co^{2+}$	49	$\frac{1}{2}Mg^{2+}$	53·06	Et_4N^+	32·66
$\frac{1}{3}Co(NH_3)_6^{3+}$	99·20	$\frac{1}{2}Mn^{2+}$	53·5	Pr_4N^+	23·45
$\frac{1}{3}Co(en)_3^{3+}$	74·71	NH_4^+	73·4	Bu_4N^+	19·13
$\frac{1}{3}Co(pn)_3^{3+}$	65·06	$\frac{1}{3}Nd^{3+}$	69·4	Am_4N^+	17·13
$\frac{1}{2}Co(NH_3)_5Cl^{2+}$	68	$\frac{1}{2}Ni^{2+}$	54	Me_3HN^+	42
$Co(NH_3)_4CO_3$	52·9	$\frac{1}{2}Pb^{2+}$	70	Et_3HN^+	34
$\frac{1}{3}Cr^{3+}$	67	$\frac{1}{3}Pr^{3+}$	69·5	$Pr_2H_2N^+$	29
$\frac{1}{2}Cu^{2+}$	56·6	$\frac{1}{3}Sm^{3+}$	68·5	PrH_3N^+	41
$\frac{1}{3}Dy^{3+}$	65·6	$\frac{1}{2}Sr^{2+}$	59·46	$C_5H_{12}N^+$	37
$\frac{1}{3}Er^{3+}$	65·9	$\frac{1}{4}Th^{4+}$	27·8	$HOC_2H_5NH_3^+$	42·23
$\frac{1}{3}Eu^{3+}$	67·8				

ANIONS AT 25°C

Ion	λ°	Ion	λ°	Ion	λ°
$Au(CN)_4^-$	32	MnO_4^-	61·3	$Me(CH_2)_2COO^-$	35·1
$\frac{1}{2}Au(CN)_6^{2-}$	45	MoO_4^-	74·5	Me_2CHCOO^-	34·2
BrO_3^-	55·84	NO_3^-	71·44	$Me(CH_2)_3COO^-$	33·4
CN^-	82	OH^-	197·6	$Me_2CHCH_2COO^-$	32·7
CNS^-	66	$\frac{1}{3}PO_4^{3-}$	92·8	Me_3CCOO^-	31·9
$\frac{1}{2}CO_3^{2-}$	69·3	$\frac{1}{3}P_3O_9^{3-}$	83·59	$COOHCOO^-$	40·2
ClO_3^-	64·58	$\frac{1}{4}P_4O_{12}^{4-}$	93·69	$\frac{1}{2}(COO)_2^{2-}$	24·0
ClO_4^-	67·31	$\frac{1}{4}P_3O_{10}^{4-}$	109	$\frac{1}{2}CH_2(COO)_2^{2-}$	13·4
$\frac{1}{3}Co(CN)_6^{3-}$	98·9	ReO_4^-	54·95	$\frac{1}{2}(CH_2)_2(COO)_2^{2-}$	57·3
$\frac{1}{2}CrO_4^{2-}$	83	$\frac{1}{2}SO_4^{2-}$	80·0	$\frac{1}{2}(CH_2)_3(COO)_2^{2-}$	52·6
F^-	55·4	$\frac{1}{2}S_2O_3^{2-}$	87·4	$\frac{1}{2}cis\text{-}(CH)_2(COO)_2^{2-}$	61·9
$\frac{1}{3}Fe(CN)_6^{3-}$	99·1	$Sb(OH)_6^-$	31·9	$\frac{1}{2}tr\text{-}(CH)_2(COO)_2^{2-}$	61·8
$\frac{1}{4}Fe(CN)_6^{4-}$	111	$\frac{1}{2}WO_4^{2-}$	69·4	$\frac{1}{2}CH_2CHOH(COO)_2^{2-}$	58·8
$H_2AsO_4^-$	34	$HCOO^-$	54·6	$\frac{1}{2}(CHOH)_2(COO)_2^{2-}$	59·6
HCO_3^-	44·5	$MeCOO^-$	40·9	$\frac{1}{2}o\text{-}C_6H_4(COO)_2^{2-}$	52·3
$H_2PO_4^-$	36	$BrCH_2COO^-$	39·3	$\frac{1}{2}m\text{-}(C_6H_4(COO)_2^{2-}$	54·7
HSO_4^-	52	$ClCH_2COO^-$	39·8	$C_6H_5COO^-$	32·3
IO_3^-	40·75	$CNCH_2COO^-$	41·8	$246\text{-}(NO_2)_3C_6H_2COO^-$	30·39
IO_4^-	54·53	$MeCH_2COO^-$	35·8		

CONSTANTS FOR THE EQUATION $\lambda^\circ = \lambda^\circ_{(25°C)} + a(t-25) + b(t-25)^2 + c(t-25)^3$

Valid in the range $t = 5°C$ to $55°C$

Ion	$\lambda^\circ_{(25°C)}$	a	$b \times 10^2$	$-c \times 10^4$	Ion	$b \times 10^2$	$\lambda^\circ_{(25°C)}$	a	$b \times 10^4$
H^+	349·85	4·81595	−1·03125	0·7670	Cs^+	77·26	1·44790	0·38250	0·2050
Li^+	38·64	0·88988	+0·44075	0·2042	Cl^-	76·35	1·54037	0·46500	0·1285
Na^+	50·15	1·09160	0·47150	0·1150	Br^-	78·17	1·54370	0·44700	0·2300
K^+	73·50	1·43262	0·40563	0·3183	I^-	76·85	1·50893	0·43750	0·2170
Rb^+	77·81	1·47953	0·38400	0·4533					

80 LIMITING IONIC MOBILITIES IN METHANOL AT 25°C (in ohm^{-1} cm^2)

Ion	$\lambda°$
K^+	52·40
Li^+	39·82
Na^+	45·22
Me_4N^+	68·9
Et_4N^+	60·4
nPr_4N^+	46·1
nBu_4N^+	39·1
nBu_3NH^+	42·1
iAm_4N^+	35·5
n-Octadecyl-Me_3N^+	35·1
Br^-	56·55
CNS^-	62·0
Cl^-	52·38
I^-	62·75
Picrate$^-$	47·0
n-Octadecyl sulphate	30·7

81 CONSTANTS FOR THE EQUATION $t_+ = B+A\sqrt{c}$

Valid for c = 0·01 − 0·1 at 25°C

Salt	B	$-A$
$ErBr_3$	0·4555	0·137
$GdBr_3$	0·4689	0·132
$HoBr_3$	0·4586	0·135
$LaBr_3$	0·4672	0·110
$NdBr_3$	0·4689	0·113
$PrBr_3$	0·4697	0·120
$CeCl_3$	0·4746	0·113
$DyCl_3$	0·4655	0·120
$ErCl_3$	0·4601	0·125
$EuCl_3$	0·4726	0·116
$GdCl_3$	0·4737	0·131
$HoCl_3$	0·4613	0·126
$NdCl_3$	0·4776	0·120
$PrCl_3$	0·4753	0·114
$SmCl_3$	0·4745	0·112
$TmCl_3$	0·4604	0·118
$YbCl_3$	0·4604	0·125
$Er(ClO_4)_3$	0·4947	0·112
$Gd(ClO_4)_3$	0·501	0·100
$Ho(ClO_4)_3$	0·4909	0·092
$La(ClO_4)_3$	0·5038	0·101
$Nd(ClO_4)_3$	0·5067	0·093
$Pr(ClO_4)_3$	0·5067	0·102
$Sm(ClO_4)_3$	0·5072	0·102
$Yb(ClO_4)_3$	0·4930	0·111
$Gd(NO_3)_3$	0·4857	0·075
$La(NO_3)_3$	0·4895	0·060
$Nd(NO_3)_3$	0·4922	0·070

82 CATION TRANSPORT NUMBERS AT 25°C IN AQUEOUS SOLUTION AND CONSTANTS FOR THE LIMITING EQUATION

$$t_+ = t_+° + A\sqrt{c}$$

Salt	A	$t_+°$	c = 0·01	c = 0·02	c = 0·05	c = 0·1	c = 0·2
$AgNO_3$	−0·01604	0·4643	0·4648	0·4652	0·4664	0·4682	
HCl	+0·04507	0·8209	0·8251	0·8266	0·8292	0·8314	0·8337
KBr	−0·00596	0·4849	0·4833	0·4832	0·4831	0·4833	0·4841
$K_4Fe(CN)_6$		0·603	0·485	0·445	0·396	0·353	
$K_3Fe(CN)_6$		0·578	0·569		0·560	0·558	
KI	−0·00430	0·4892	0·4884	0·4883	0·4882	0·4883	0·4887
KNO_3	+0·00297	0·5072	0·5084	0·5087	0·5093	0·5103	0·5120
$KOOCCH_3$	+0·07467	0·6427	0·6498	0·6523	0·6569	0·6609	
K_2SO_4	+0·1048	0·479	0·4829	0·4848	0·4870	0·4890	0·4910
$LaCl_3$	−0·3170	0·477	0·4625	0·4576	0·4482	0·4375	0·4233
$LiCl$	−0·08514	0·3364	0·3289	0·3261	0·3211	0·3168	0·3112
NH_4Cl	−0·00363	0·4909	0·4907	0·4906	0·4905	0·4907	0·4911
$NaOOCCH_3$	+0·03336	0·5507	0·5537	0·5550	0·5573	0·5594	0·5610
Na_2SO_4	+0·0447	0·386	0·3848	0·3836	0·3829	0·3828	0·3828

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83 CATION TRANSPORT NUMBERS FOR H_2SO_4 IN AQUEOUS SOLUTION

m	0°C	15°C	25°C	35°C	45°C	60°C
0·0	0·840	0·824	0·813	0·801	0·788	0·761
0·05	0·839	0·830	0·819	0·807	0·793	0·770
0·1	0·838	0·829	0·819	0·807	0·793	0·770
0·2	0·837	0·829	0·819	0·806	0·792	0·770
0·5	0·834	0·824	0·815	0·801	0·787	0·764
1·0	0·828	0·818	0·808	0·793	0·779	0·755
2·0	0·816	0·803	0·793	0·779	0·763	0·737
3·0	0·803	0·788	0·776	0·762	0·747	0·720
5·0	0·772	0·756	0·744	0·730	0·715	0·689
8·0	0·720	0·702	0·690	0·676	0·663	0·641
10·0	0·682	0·666	0·655	0·642	0·629	0·610
12·0	0·638	0·625	0·616	0·605	0·595	0·578
14·0	0·591	0·580	0·573	0·564	0·556	0·543
17·0	0·512	0·506	0·502	0·498	0·494	0·488

84 CATION TRANSPORT NUMBERS IN AQUEOUS SOLUTION

(*a*) $CaCl_2$

c	15°C	25°C	35°C
0·0	0·4334	0·4380	0·4427
0·0005			
0·001			
0·002			
0·005	0·4261	0·4307	0·4354
0·01	0·4231	0·4277	0·4324
0·02	0·4188	0·4234	0·4281
0·03	0·4156	0·4202	0·4249
0·05	0·4105	0·4151	0·4198
0·07	0·4067	0·4113	0·4160
0·1	0·4024	0·4070	0·4117
0·15	0·3964	0·4010	0·4057

Table 84 (*cont.*)

	(*b*) KCl				(*c*) NaCl			
c	15°C	25°C	35°C	45°C	15°C	25°C	35°C	45°C
0·0	0·4928	0·4905	0·4889	0·4872	0·3929	0·3962	0·4002	0·4039
0·0005					0·3918	0·3951	0·3992	0·4028
0·001					0·3914	0·3947	0·3987	0·4023
0·002					0·3908	0·3941	0·3981	0·4018
0·005	0·4926	0·4903	0·4887	0·4869	0·3897	0·3930	0·3970	0·4008
0·01	0·4925	0·4902	0·4886	0·4868	0·3885	0·3918	0·3958	0·3996
0·02	0·4924	0·4901	0·4885	0·4868	0·3870	0·3903	0·3943	0·3982
0·03								
0·05	0·4923	0·4900	0·4885	0·4869	0·3846	0·3878	0·3919	0·3957
0·07					0·3837	0·3869	0·3909	0·3947
0·1	0·4921	0·4900	0·4888	0·4873	0·3820	0·3853	0·3892	0·3932
0·15								

85 CATION TRANSPORT NUMBERS AT 25°C

in 50 mole % methanol			in Anhydrous methanol				
c	KCl	NaCl	c	KCl	NaCl	m	H_2SO_4
0·0	0·5068	0·4437	0·0	0·5001	0·4633	0·01375	0·726
0·0005	0·5069	0·4428	0·0002	0·5001	0·4625	0·02522	0·725
0·001	0·5070	0·4425	0·0005	0·5002	0·4620	0·07151	0·727
0·002	0·5071	0·4421	0·001	0·5002	0·4615	0·14118	0·729
0·003	0·5072	0·4418	0·002	0·5003	0·4609	0·27714	0·734
0·005	0·5074	0·4415	0·003	0·5004	0·4603	0·54434	0·742
0·007	0·5075	0·4413	0·005	0·5007	0·4595		
0·01	0·5077	0·4412	0·007	0·5009	0·4588		
0·02	0·5085	0·4412	0·01	0·5013	0·4582		
0·03	0·5092	0·4408	0·02	0·5012			
0·05	0·5105	0·4398					
0·08	0·5114	0·4388					

c = Concentration (mole $litre^{-1}$).
m = molality (moles solute per 1000 g water).

86 CATION TRANSPORT NUMBERS (t_+) IN WATER AT 25°C

$CdSO_4$ *m*	t_+
0·001737	0·384
0·004731	0·384
0·01286	0·384
0·05216	0·384
0·0995	0·370
0·2361	0·330
0·5058	0·295
0·7384	0·280
0·975	0·266
1·297	0·249
1·640	0·234
1·961	0·220
2·211	0·207
2·400	0·199

$ZnSO_4$ *m*	t_+
0·0	0·398
0·005	0·389
0·01	0·389
0·05	0·389
0·1	0·384
0·15	0·359
0·25	0·331
0·5	0·294
1·0	0·255
1·5	0·226
2·0	0·197

$MgCl_2$ *m*	t_+
0·0	0·395
0·0032	0·396
0·0038	0·404
0·0073	0·391
0·017	0·380
0·028	0·380
0·036	0·376
0·052	0·375

ZnI_2 *m*	t_+
0·05	0·382
0·1	0·363
0·3	0·332
0·6	0·317
1·0	0·291
1·3	0·269
1·6	0·234
1·9	0·192
2·5	0·115
3·0	0·056
4·0	−0·050
5·0	−0·190
5·75	−0·300
8·0	−0·444
10·0	−0·550

$ZnBr_2$ *m*	t_+
0·02	0·389
0·05	0·366
0·1	0·349
0·2	0·331
0·5	0·306
1·0	0·286
1·2	0·261
1·4	0·238
1·6	0·216
1·8	0·199
2·0	0·181
3·0	−0·059
3·5	−0·108
4·0	−0·151
4·5	−0·194
5·0	−0·233
6·0	−0·306
7	−0·380
8	−0·445
9	−0·507
10	−0·563
11	−0·597
12	−0·597
13	−0·597
14	−0·597
15	−0·597
16	−0·597

$ZnCl_2$ *m*	t_+
0·50	0·331
0·70	0·249
0·90	0·194
1	0·171
2	0·000
3	−0·137
4	−0·256
5	−0·364
6	−0·456
7	−0·524
8	−0·562
9	−0·593
10	−0·559
11	−0·548
12	−0·522

$Zn(ClO_4)_2$ *m*	t_+
0·1	0·409
0·15	0·397
0·2	0·389
0·3	0·377
0·4	0·368
0·5	0·361
0·6	0·355
0·7	0·349
0·8	0·344
0·9	0·340
1·0	0·335
1·1	0·331
1·2	0·328
1·3	0·324
1·4	0·320
1·5	0·317
1·6	0·314
1·7	0·311
1·8	0·308
2·0	0·303
2·5	0·291
3·0	0·281
3·5	0·275
4·0	0·271

87 CATION TRANSPORT NUMBERS IN ANHYDROUS H_2SO_4 AT 25°C

Salt	*m*	t_+	Salt	*m*	t_+	$KHSO_4$		
						°C	*m*	t_+
$AgHSO_4$	0·2490	0·026	$LiHSO_4$	0·5562	0·013	25·0	0·6244	0·030
	0·3056	0·022	$Ba(HSO_4)_2$	0·1738	0·009	36·8	0·6536	0·032
$KHSO_4$	0·6244	0·030		0·1969	0·009	45·1	0·6388	0·031
	1·2262	0·025		0·2073	0·008	55·0	0·7098	0·033
$NaHSO_4$	0·7918	0·021		0·2292	0·010	61·0	0·6556	0·035
$Sr(HSO_4)_2$	0·2111	0·007		0·2418	0·008			
	0·2788	0·007		0·3062	0·008			
	0·5819	0·005		0·5391	0·005			
	0·8247	0·003		0·7981	0·004			

88 CATION TRANSPORT NUMBERS FOR HCl IN WATER AND DIOXAN+WATER MIXTURES

m	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C	45°C	50°C
WATER											
0·0		0·842	0·837	0·831	0·826	0·821	0·816	0·811	0·806	0·801	0·796
0·005		0·844	0·840	0·834	0·829	0·824	0·819	0·814	0·809	0·804	0·799
0·01		0·845	0·841	0·835	0·830	0·825	0·821	0·816	0·811	0·806	0·801
0·02		0·846	0·842	0·836	0·832	0·827	0·822	0·818	0·813	0·808	0·803
0·05		0·848	0·844	0·838	0·834	0·830	0·825	0·821	0·816	0·811	0·806
0·1		0·850	0·846	0·840	0·837	0·832	0·828	0·823	0·819	0·814	0·810
0·2		0·851	0·847	0·843	0·839	0·835	0·830	0·827	0·823	0·818	0·814
0·5		0·854	0·850	0·846	0·842	0·838	0·834	0·831	0·827	0·822	0·819
1·0		0·855	0·852	0·848	0·844	0·841	0·837	0·833	0·829	0·824	0·821
1·5		0·857	0·853	0·849	0·845	0·842	0·839	0·835	0·830	0·825	0·822
2·0		0·857	0·853	0·849	0·846	0·843	0·839	0·835	0·831	0·826	0·822
3·0		0·858	0·854	0·850	0·846	0·843	0·840	0·836	0·832	0·827	0·823
20% DIOXAN BY WEIGHT											
0·0	0·856	0·851	0·846	0·841	0·836	0·831	0·825	0·821	0·816	0·810	0·805
0·005	0·861	0·855	0·850	0·845	0·840	0·835	0·829	0·825	0·820	0·814	0·809
0·01	0·862	0·857	0·851	0·846	0·841	0·836	0·831	0·827	0·821	0·816	0·811
0·02	0·865	0·859	0·853	0·848	0·843	0·838	0·833	0·829	0·824	0·818	0·813
0·05	0·867	0·861	0·856	0·851	0·846	0·841	0·837	0·832	0·827	0·822	0·816
0·1	0·868	0·862	0·857	0·852	0·848	0·843	0·839	0·834	0·829	0·823	0·818
0·2	0·869	0·863	0·858	0·853	0·849	0·844	0·840	0·835	0·830	0·825	0·820
0·5	0·867	0·862	0·857	0·852	0·847	0·843	0·838	0·833	0·829	0·823	0·818
1·0	0·864	0·860	0·854	0·849	0·844	0·840	0·836	0·831	0·826	0·821	0·816
1·5	0·862	0·857	0·852	0·847	0·842	0·838	0·834	0·829	0·824	0·819	0·814
2·0	0·860	0·855	0·850	0·845	0·841	0·836	0·832	0·828	0·823	0·818	0·813
3·0	0·856	0·852	0·847	0·842	0·838	0·833	0·829	0·825	0·820	0·816	0·811
45% DIOXAN BY WEIGHT											
0·0	0·828	0·824	0·820	0·816	0·811	0·806	0·801	0·796	0·791	0·787	0·783
0·005	0·833	0·829	0·825	0·821	0·816	0·811	0·807	0·801	0·797	0·793	0·788
0·01	0·835	0·830	0·827	0·823	0·818	0·813	0·809	0·804	0·799	0·795	0·790
0·02	0·838	0·833	0·829	0·825	0·820	0·816	0·811	0·807	0·802	0·798	0·793
0·05	0·842	0·837	0·833	0·829	0·824	0·820	0·816	0·812	0·807	0·803	0·798
0·1	0·845	0·840	0·836	0·831	0·827	0·823	0·819	0·816	0·811	0·807	0·803
0·2	0·849	0·844	0·840	0·834	0·830	0·826	0·823	0·820	0·816	0·812	0·807
0·5	0·851	0·846	0·842	0·836	0·833	0·829	0·826	0·822	0·819	0·815	0·811
1·0	0·851	0·846	0·841	0·836	0·832	0·828	0·825	0·822	0·819	0·815	0·811
1·5	0·850	0·845	0·840	0·835	0·832	0·828	0·824	0·821	0·818	0·814	0·810
2·0	0·849	0·844	0·839	0·835	0·831	0·827	0·824	0·820	0·817	0·813	0·809
3·0	0·847	0·843	0·838	0·833	0·830	0·825	0·822	0·817	0·814	0·810	0·807

Table 88 (*cont.*)

m	0°C	5°C	10°C	15°C	20°C	25°C	30°C	35°C	40°C	45°C	50°C
70% DIOXAN BY WEIGHT											
0·0		0·772	0·768	0·764	0·760	0·755	0·750	0·746	0·742	0·738	0·734
0·005		0·781	0·778	0·774	0·770	0·766	0·761	0·757	0·753	0·750	0·747
0·01		0·783	0·780	0·777	0·773	0·769	0·764	0·760	0·756	0·753	0·751
0·02		0·786	0·783	0·779	0·776	0·772	0·767	0·763	0·760	0·757	0·755
0·05		0·788	0·785	0·782	0·778	0·774	0·770	0·766	0·763	0·760	0·758
0·1		0·789	0·786	0·783	0·780	0·775	0·771	0·768	0·765	0·762	0·759
0·2		0·789	0·786	0·784	0·780	0·776	0·771	0·768	0·765	0·762	0·759
0·5		0·789	0·786	0·783	0·779	0·774	0·770	0·766	0·764	0·760	0·757
1·0		0·788	0·785	0·782	0·777	0·772	0·768	0·764	0·762	0·758	0·754
1·5		0·788	0·784	0·781	0·776	0·771	0·766	0·763	0·760	0·757	0·752
82% DIOXAN BY WEIGHT											
0·0		0·677	0·675	0·673	0·672	0·670	0·668	0·667	0·665	0·663	
0·05		0·742	0·735	0·730	0·726	0·722	0·717	0·712	0·708	0·702	
0·1		0·767	0·764	0·762	0·759	0·756	0·754	0·752	0·750	0·747	
0·2		0·755	0·751	0·747	0·744	0·740	0·738	0·735	0·732	0·729	
0·3		0·718	0·715	0·711	0·708	0·705	0·702	0·699	0·696	0·693	
0·5		0·660	0·657	0·654	0·651	0·648	0·645	0·642	0·639	0·637	

89 CATION TRANSPORT NUMBERS (t_+) IN ANHYDROUS ACETIC ACID AT 25°C

NH_4OOCCH_3		$NaOOCCH_3$	
m	t_+	m	t_+
0·1923	0·52	0·3439	0·48
0·2198	0·48	0·4809	0·46
0·3003	0·50	0·5578	0·45
0·3814	0·48	0·5831	0·47
0·5214	0·486	0·6268	0·44
0·6714	0·487	0·6727	0·45
0·9790	0·478	0·6783	0·44
1·4455	0·469	0·7093	0·43
1·6053	0·463	0·7973	0·43
2·4298	0·449	0·8869	0·39

POLAROGRAPHIC HALF-WAVE POTENTIALS (IN VOLTS VS. THE NORMAL CALOMEL ELECTRODE) IN AQUEOUS SOLUTION

90 DEPOSITION POTENTIALS OF SOME CATIONS IN VARIOUS SOLUTIONS

Ion	N	A	B
Li^+	−2·31		−2·31
Ca^{2+}	−2·23		−2·23
K^+	−2·17		−2·17
Na^+	−2·15		−2·15
Sr^{2+}	−2·13		−2·13
Cs^+	−2·09		−2·09
Rb^+	−2·07		−2·07
NH_4^+	−2·08	−2·15[b]	−2·29
$NH_3CH_3^+$	−2·08[a]		
$NH_2(CH_3)_2^+$	−2·09[a]		
$NH(CH_3)_3^+$	−2·27		
$N(CH_3)_4^+$	−2·7		
$N(C_2H_5)_4^+$	−2·71		
$N(C_3H_7)_4^+$	−2·56		
$N(C_4H_9)_4^+$	−2·61		
Rare Earth Metals		−1·9 to −2·0	
Ba^{2+}	−1·90	−1·94	−1·96
Ra^{2+}	−1·89	−1·89	
Sc^{3+}		−1·84	
Zr^{4+}		−1·7	

a Tangent potential.
b Weakly acid.
c Varies with pH.
d pH = 2.
e 0·007 M acetic acid in LiCl, pH = 3·6.
f Strong acids.
g 0·5 M ammonium tartrate, pH = 10.
h Solubility can be increased by complexing with, e.g., glycerol, in amitol.
i In 0·05 M borax, $E_{1/2} = -1{\cdot}72$.
j Indistinct waves in 1 N H_2SO_4.
k In 0·1 M KI.
l 2 M $HClO_4$ + 0·5 M KCl.
m 0·1 M pyrophosphate, $E_{1/2} = -0{\cdot}73$.
n 0·5 M H_2SO_4.
o 0·1 M pyrophosphate $E_{1/2} = -1{\cdot}37$.
p 1 M chloride.
q $KAg(CN)_2$.
s See redox table.
t In the presence of $LaCl_3$.
u In the presence of carbonates.
v In 8 M HCl.
w With 4 M NH_4Cl.
x In 10 M H_2SO_4.
y In conc. HCl.
z On Pt wire electrode.

→ No wave observed before depolarisation by supporting electrolyte.
↑ Metal reacts with mercury, mercury dissolves.
( ) Poorly defined waves.
[ ] Solubility small.

For half-wave potentials of organic systems, see ZUMAN, P., *Coll. Czech. Chem. Comm.*, 15 (1950), 1107.

Table 90 (*cont.*)

Ion	*N*	*A*	*B*	*C*	*D*	*E*	*F*	*G*	*H*	*I*	*J*	*K*	*L*	*M*
Al^{III}		−1·7[c]							−1·83					
H$^+$	−1·77[e]	−1·60[f]												
Mn^{II}	−1·51		[−1·74]	−1·67	−1·37	−1·59	−1·59				−1·7	−1·38	−1·65	
Cr^{II}	−1·57		−1·98	−1·74										
Fe^{II}	−1·32		[−1·5][h]	−1·52	→	−1·4			→	→	−1·6[g]			−1·6
Ga^{III}		−1·3		−1·6	(−1·33)									
Co^{II}	−1·3		[−1·47]	−1·32	−1·3	−1·07	−1·42	−1·11		−1·6		−1·00		
Ni^{II}	−1·1			−1·14	−1·44	−0·74	−1·16	−0·82		→		−0·9	−1·39	−1·22
Zn^{II}	−1·02		−1·53	−1·38	→	−1·1	−1·17		−1·27	−1·19	−1·46	−1·08	−1·49	−1·40
As^{III} [i]		−0·7, −1·0[j]							−1·04					
In^{III}	−0·57[k]	−0·63	−1·13	insol						−0·8				
Cd^{III}	−0·63		[−0·80]	−0·85	−1·15		−0·67		−0·68	−0·68	−0·83	−0·7	−0·81	−0·85
Sn^{II}		−0·39[l]	−1·26				−0·77		−0·58	−0·96	−1·20	−0·46	−1·43	
Pb^{II} [m]	−0·43		−0·80	insol	−0·74		−0·45		−0·52	−0·54	−0·79	−0·52	−0·80	−0·59
Tl^{I}	−0·50		−0·50	−0·52	↑		−0·53		−0·49	−0·49	−0·50			
Sb^{III}		−0·3[n]	−1·30		−1·17		−0·72		−0·84	−1·04, −1·24	−1·36		→	
Bi^{III}		−0·03	[−0·6][h]				−0·11		−0·33	−0·74	−1·04	−0·2	−0·78	
Cu^{II}	−0·03		[−0·5]	s	→	−0·04	s		−0·13	−0·16	−0·4, −1·6	−0·32	−0·50	−0·25
Cu^{I} [o]	−0·22[p]			−0·54			−0·43	−0·29						−0·54
Pd^{II}	↑	↑		−0·74	−1·81			−0·36						
Ir^{III}	↑	↑		→	→		−1·44	→						
Pt, Ru	↑	↑		→	→		↑	→						
Au^{III}	↑	↑	−0·6		↑		↑							
Au^{I}	↑	↑	−1·3		−1·5		↑	→						
Ag^{I}	↑	↑			(−0·3)[q]		↑							
Hg^{I}, Hg^{II}	↑	↑			↑		↑							

SOLUTIONS

N—neutral solution 0·1 N NaClO$_4$ (or 0·1 N KCl)
A—acid solution
B—1 N solution of base
C—1 N NH$_4$OH + 1 N NH$_4$Cl
D—1 M KCN
E—1 M KCNS
F—0·5 M Na$_2$F$_2$
G—0·2 M pyridine + 0·1 N HCl
H—acid tartrate pH = 4·5
I—0·5 M sodium tartrate
J—alkaline tartrate pH = 13
K—CaCl$_2$
L—0·3 M triethanolamine, 0·1 N KOH
M—0·3 M triethanolamine, 0·5 N NH$_4$OH, NH$_4$Cl

91 ANODIC DEPOLARIZATION POTENTIALS

Process	Solution	$E_{1/2}$
Hg + Cl$^-$ → HgCl	Anion concentration = 0·001 M	+0·21
Hg + N$_3$$^-$ → HgN$_3$		+0·21
Hg + CNS$^-$ → HgCNS		+0·14
Hg + Br$^-$ → HgBr		+0·10
Hg + 2OH$^-$ → HgO		+0·04
Hg + 2SO$_3$$^{2-}$ → Hg(SO$_3$)$_2$		−0·05
Hg + I$^-$ → HgI		−0·07
Hg + 2S$_2$O$_3$$^{2-}$ → Hg(S$_2$O$_3$)$_2$$^{2-}$		−0·18
Hg + 2CN$^-$ → Hg(CN)$_2$		−0·4
Hg + S^{2-} → HgS		−0·6
Fe^{II} → Fe^{III}	0·1 N KHF$_2$	+0·08
Fe^{II} → Fe^{III}	*C*	−0·38
Mn^{II} → Mn^{III}	2 N KOH, tartrate	−0·40
Re^{I} → Re^{II}	1 N HClO$_4$	−0·54
Re^{II} → Re^{III}	1 N HClO$_4$	−0·42
Re^{III} → Re^{V}	1 N HClO$_4$	−0·26
Re^{V} → Re^{VII}	1 N HClO$_4$	0·0
Cr^{II} → Cr^{III}	0·1 N Na$_2$SO$_4$	−0·62
Sn^{II} → Sn^{IV}	HCl	−0·06
Sn^{II} → Sn^{IV}	tartrate pH = 2·3	−0·18
Sn^{II} → Sn^{IV}	tartrate pH = 7	−0·48
Sn^{II} → Sn^{IV}	tartrate pH = 13	−0·75
Sn^{II} → Sn^{IV}	1 N KOH	−0·77
Sn^{II} → Sn^{IV}	*F*	−0·24
Sb^{III} → Sb^{V}	0·5 N KOH	−0·34
As^{III} → As^{V}	0·5 N KOH	−0·25
Ti^{III} → Ti^{IV}	HCl	−0·18
V^{IV} → V^{V}	pH = 6·8	+0·07
V^{IV} → V^{V}	*C*	−0·36
V^{IV} → V^{V}	1 N KOH	−0·46

92 INORGANIC OXIDATION REDUCTION POTENTIALS

Process	Solution	$E_{1/2}$
Cu^{I} ⇌ Cu^{II}	0·1 N Na$_2$SO$_4$	−0·06
Cu^{I} ⇌ Cu^{II}	*C*	−0·25
Cu^{I} ⇌ Cu^{II}	Citrate buffer pH = 7·0	−0·21
Cr^{II} ⇌ Cr^{III}	Saturated CaCl$_2$	−0·55
Cr^{II} ⇌ Cr^{III}	*D*	−1·42
Mn^{II} ⇌ Mn^{III}	Triethanolamine, 0·5 N NaOH	−0·49
Fe^{II} ⇌ Fe^{III}	1 N Sodium oxalate	−0·30
Fe^{II} ⇌ Fe^{III}	Citrate buffer pH = 4·0	−0·04
Fe^{II} ⇌ Fe^{III}	Citrate buffer pH = 7·0	−0·49
Fe^{II} ⇌ Fe^{III}	Tartrate buffer pH = 10·0	−0·9
Fe^{II} ⇌ Fe^{III}	1 N KOH	−0·9
Ti^{III} ⇌ Ti^{IV}	Saturated CaCl$_2$	−0·15
Ti^{III} ⇌ Ti^{IV}	0·1 N KCNS	−0·49
Ti^{III} ⇌ Ti^{IV}	Citric or tartaric acid	−0·48
V^{II} ⇌ V^{III}	1 N H$_2$SO$_4$	−0·55
V^{II} ⇌ V^{III}	1 N oxalate, pH = 4·5	−1·16
U^{III} ⇌ U^{IV}	1 N HCl	−0·93
Np^{III} ⇌ Np^{IV}	1 N HCl	−0·10
Pu^{III} ⇌ Pu^{IV}	1 N HCl[z]	+0·65

93 REDUCTION POTENTIALS OF INORGANIC COMPOUNDS

Process	*A*	*N*	*C*	*B*
$O_2 \rightarrow H_2O_2$	−0·05	−0·1[a]	−0·17[a]	−0·20[a]
$H_2O_2 \rightarrow H_2O$	−0·94	−1·1	−1·1	−1·2
$(CN)_2 \rightarrow 2CN^-$		−1·15[a]		
$SO_2 \rightarrow SO_2^{2-}$	−0·54	−1·13		
$NO \rightarrow NH_3$	−0·76			
$NO_2^-, NO_3^- \rightarrow NH_3$		−1·3[t]		
$IO^- \rightarrow I^-$				↑
$ClO^- \rightarrow Cl^-$		+0·08		
$BrO_3^- \rightarrow Br^-$	−0·97	−1·85	−1·72	−1·85
$IO_3^- \rightarrow I^-$	−0·30	−1·3	−1·2	−1·25
$IO_4^- \rightarrow IO_3^-$	+0·15	−0·4		
$ReO_4^- \rightarrow Re^{IV}$	−0·4			
$ReO_4^- \rightarrow Re^-$		−1·4		
$UO_2^{2+} \rightarrow U^{V}$	−0·18	−0·28[u]	−0·8	
$\rightarrow U^{IV}(U^{III})$	−0·94	−1·08	−1·4	
$Eu^{III} \rightarrow Eu^{II}$	−0·77	−0·67		
$Yb^{III} \rightarrow Yb^{II}$	−1·48	−1·41		
$Sm^{III} \rightarrow Sm^{II}$	−1·80			
$Sb^{V} \rightarrow Sb^{III}$	−0·30[v]			
$Sn^{IV} \rightarrow Sn^{II}$	−0·29[w]			
$Ti^{IV} \rightarrow Ti^{III}$	−0·81	−0·98		
$V^{IV} \rightarrow V^{II}$	−0·85			
$VO_3^- \rightarrow (V^{III})$	−0·9		−0·97	−1·66
$\rightarrow V^{II}$			−1·26	
$Co^{III} \rightarrow Co^{II}$			−0·41	
$Rh^{III} \rightarrow Rh^{II}$			−0·97	
$Cr^{III} \rightarrow Cr^{II}$	−0·78	−0·96	−1·46	
$CrO_4^{2-} \rightarrow Cr^{III}$		−0·30	−0·36	−0·89
$\rightarrow (Cr^{II})$		−1·00		
$MoO_4^{2-} \rightarrow Mo^{III}$	−0·26[x]	(−0·82)		→
$WO_4^{2-} \rightarrow W^{III}$	−0·42[y]	→		→
$SeO_3^{2-} \rightarrow Se$	−0·12 −0·4		−1·5	
$TeO_3^{2-} \rightarrow Te$	−0·48		−0·7	
$Os^{VI} \rightarrow Os^{IV}$				−0·44
$Os^{IV} \rightarrow Os^{II}$				−1·20

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94 TAFEL CONSTANTS AND HEATS OF ACTIVATION FOR HYDROGEN EVOLUTION FROM AQUEOUS SOLUTION

The Tafel equation is $\eta = a - b \log_{10} i = b \log_{10}(i_0/i)$, where η is the overpotential (mV), i is the current (amp cm^{-2}), i_0 is the exchange current (amp cm^{-2}). $\Delta H_0^{\ddagger}$ is the experimental heat of activation at the reversible potential (in kcal.).

Metal	Electrolyte	Temp. °C	$-\log_{10}i$ range	$-a$ mV	b mV	$-\log_{10}i_0$	$\Delta H_0^{\ddagger}$ kcal	Temp. range °C
Ag	0·001 N HCl	20	6·0 to 2·0	810	125	6·5		
	0·01 N HCl	20	6·0 to 2·0	820	130	6·3		
	0·1 N HCl	20	6·0 to 3·3	570	90	6·3		
	0·1 N HCl	20	3·3 to 1·0	670	120	5·6		
	1·0 N HCl	20	6·0 to 2·3	320	60	5·4		
	1·0 N HCl	20	2·3 to 1·0	480	130	3·7		
	5·0 N HCl	20	6·0 to 2·8	470	70	6·7		
	5·0 N HCl	20	2·8 to −2	630	120	5·3		
	7·0 N HCl	20	6·0 to 3·4	640	90	7·1		
	7·0 N HCl	20	3·4 to 1·0	740	110	6·7		
Al	2 N H_2SO_4	25	3·0 to 0·7	1000	100	10		
Au	0·001 N HCl	20	7·0 to 2·0	524	72	7·32		
	0·01 N HCl	20	6·0 to 2·0	558	84	6·63		
	0·1 N HCl	20	6·0 to 3·0	468	71	6·59		
	0·1 N HCl	20	3·0 to 2·0	548	97	5·64		
	0·001 N NaOH	20	6·0 to 4·5	832	118	7·05		
	0·01 N NaOH	20	6·5 to 3·7	836	119	7·04		
	0·1 N NaOH	20	4·8 to 3·0	856	123	6·95		
Be	1·0 N HCl	20	3·0 to 1·3	1080	120	9·		
Bi	1·0 N HCl	20	3·0 to 1·0	840	120	7·		
Cd	1·7 N H_2SO_4	20	4·0 to 3·0	1450	120	12·1		
	10 N H_2SO_4	20	4·0 to 2·0	1400	120	11·7		
Cu	0·001 N HCl	20	5·0 to 3·3	802	122	6·61	10·1	10 to 40
	0·01 N HCl	20	4·5 to 2·3	786	118	6·71	11·1	10 to 40
	0·1 N HCl	20	5·0 to 2·5	790	117	6·76	9·9	10 to 40
	0·005 N NaOH	16		890	139	6·40		
	0·02 N NaOH	16	6·0 to 3·7	710	114	6·29		
	0·15 N NaOH	16		690	117	5·99		
Fe	0·001 N HCl	20	4·0 to 3·8	787	127	6·19		
	0·01 N HCl	20	4·1 to 3·2	741	118	6·29		
	1 N HCl	16	3·0 to 0·0	770	130	5·9		
	0·01 N NaOH	20	4·5 to 3·8	776	117	6·62		
	0·1 N NaOH	20	4·1 to 3·2	726	120	6·06		
	4·8 N KOH	20	4·0 to 3·0	350	70	5·0		
	10·5 N KOH	20	4·0 to 3·0	340	70	4·9		
Ga	0·2 N H_2SO_4	87		800	120	6·7		
Hg	0·001 to 0·1 N HCl	20	7·0 to 1·0	1410	116	12·2	21·4	0 to 90
	1 N HCl	20	6·0 to 2·5	1390	119	11·7	24·	0 to 78
	3 N HCl	20	6·0 to 2·5	1420	141	10·1	9·	0 to 80
	5 N HCl	20	6·0 to 2·5	1320	127	10·4	10·	0 to 78
	7 N HCl	20	6·0 to 2·5	1130	108	10·5	19·	0 to 30
	10 N HCl	20	6·0 to 2·5	1020	95	10·7	16·	0 to 60
	0·1 N H_2SO_4	20	6·0 to 2·5	1440	114	12·7		
	0·25 N H_2SO_4	20	6·5 to 3·0	1403	116	12·1	21·1	0 to 80
	5 N H_2SO_4	20	6·5 to 3·0	1400	116	12·05		
	0·1 N LiOH	20	6·0 to 4·0	1598	102	15·7		

Table 94 (*cont.*)

Metal	Electrolyte	Temp. °C	$-\log_{10}i$ range	$-a$ mV	b mV	$-\log_{10}i_0$	$\Delta H_0^{\ddagger}$ kcal	Temp. range °C
Hg	0·2 N LiOH	20	6·0 to 4·0	1545	100	15·5		
	0·1 N NaOH	20	6·0 to 4·0	1457	100	14·6		
	0·2 N NaOH	20	6·0 to 4·0	1405	97	14·5		
	0·002 N KOH	20	6·0 to 4·0	1682	98	17·1		
	0·02 N KOH	20	6·0 to 4·0	1545	90	17·3	16·	10 to 30
	0·1 N KOH	20	6·0 to 4·0	1430	93	15·4	17·	10 to 30
	0·01 N $Ba(OH)_2$	20	6·0 to 4·0	1170	45	26·0		
	0·02 N $Ba(OH)_2$	20	6·0 to 4·0	1220	65	18·8		
	0·1 N DCl in D_2O	20	5·0 to 2·4	1485	119	12·19	22·5	4 to 70
Mo	0·001 N HCl	20	5·6 to 4·2	557	81	7·12		
	0·01 N HCl	20	5·2 to 3·7	543	76	7·19		
	0·1 N HCl	20	6·0 to 3·5	586	80	7·30		
	0·1 N HCl	20	3·5 to 2·0	671	104	6·45		
	0·001 N NaOH	20	5·9 to 4·4	667	92	7·27		
	0·01 N NaOH	20	4·9 to 3·6	664	103	6·42		
	0·1 N NaOH	20	4·7 to 3·7	641	87	7·35		
	0·1 N NaOH	20	3·6 to 2·1	739	116	6·37		
Nb	1·0 N HCl	20	3·0 to 1·0	900	80	11·		
Ni	0·00004 NHCl	20	6·0 to 5·0	650	100	6·5		
	0·001 N HCl	20	5·8 to 3·3	617	93	6·6	6·7	0 to 40
	0·01 N HCl	20	5·5 to 3·3	611	91	6·7	9·9	0 to 40
	0·1 N NCl	20	5·0 to 2·0	626	104	6·0	6·9	0 to 40
	1·0 N HCl	20	4·3 to 2·0	594	109	5·4	16·3	0 to 40
	0·001 N NaOH	20	6·8 to 4·8	720	103	7·0	7·6	2 to 40
	0·006 N NaOH	20	6·3 to 3·8	660	101	6·6	4·9	2 to 40
	0·1 N NaOH	20	6·0 to 3·0	650	101	6·4	5·7	2 to 40
Pb	0·1 N HCl	20	5·8 to 2·5	1524	116	13·2		
	1 N HCl	20	5·8 to 2·5	1531	119	12·9		
	3 N HCl	20	5·1 to 2·5	1573	142	11·1		
	5 N HCl	20	4·9 to 2·5	1495	140	10·7		
	7 N HCl	20	4·7 to 2·5	1417	138	9·76		
	10 N HCl	20	4·6 to 2·0	1195	135	8·84		
	0·1 N H_2SO_4	20	7·0 to 2·5	1533	118	13·0		
	1 N H_2SO_4	20	6·5 to 2·0	1536	119	12·9		
	8 N H_2SO_4	20	5·9 to 2·0	1530	120	12·8		
	15 N H_2SO_4	20	5·3 to 2·0	1469	121	12·1		
	20 N H_2SO_4	20	5·0 to 2·0	1411	119	11·9		
	1 N HBr	20	5·3 to 2·3	1484	116	12·7		
	3 N HBr	20	5·1 to 2·3	1467	123	11·9		
	6 N HBr	20	4·7 to 2·3	1377	130	10·6		
	8·5 N HBr	20	4·3 to 2·3	1285	140	9·17		
	1 N $HClO_4$	20	4·8 to 1·6	1537	118	13·0		
	3 N $HClO_4$	20	4·8 to 1·6	1517	118	12·8		
	7 N $HClO_4$	20	4·8 to 1·6	1504	121	12·4		
	9 N $HClO_4$	20	4·8 to 1·6	1453	122	11·9		
	11·6 N $HClO_4$	20	4·8 to 1·6	1446	132	11·0		
Pd	1·0 N H_2SO_4	20	3·0 to 2·0	240	80	3·		
	0·01 N HCl	20	3·9 to 3·1	447	107	4·18		
	0·1 N HCl	20	2·9 to 1·4	321	99	3·25		
	0·001 N NaOH	20	5·0 to 3·9	589	100	5·88		
	0·01 N NaOH	20	5·4 to 4·0	610	110	5·56		
	0·1 N NaOH	20	4·1 to 3·1	637	125	5·01		

Table 94 (*cont.*)

Metal	Electrolyte	Temp. °C	$-\log_{10}i$ range	$-a$ mV	b mV	$-\log_{10}i_0$	$\Delta H_0^{\ddagger}$ kcal	Temp. range °C
Pt	0·5 N HCl	25	2·0 to 0·7	73	28	2·6	5·2	5 to 42
Rh	0·01 N HCl	20	3·4 to 3·1	209	55	3·80		
	0·01 N NaOH	20	4·2 to 3·5	551	119	4·64		
Sb	2 N H_2SO_4	20	3·0 to 0	900	100	9·		
Sn	1 N HCl	20	3·0 to 0	1100	140	8·		
Ta	1 N HCl	20	3·0 to 1·0	550	120	4·6		
W	5 N HCl	20	2·0 to −2·0	550	110	5·0		

95 TAFEL CONSTANTS AND HEATS OF ACTIVATION FOR HYDROGEN EVOLUTION FROM NON-AQUEOUS SOLUTION

Metal	Solution	Temp. °C	$-\log_{10}i_0$ range	$-a$ mV	b mV	$-\log_{10}i_0$	$\Delta H_0^{\ddagger}$ kcal	Temp. range °C
Hg	0·1 N HCl in 10% methanol	20	6·0 to 2·0	1354	109	12·4		
	0·1 N HCl in 30% methanol	20	6·0 to 2·0	1309	106	12·3		
	0·1 N HCl in 50% methanol	20	6·0 to 2·0	1280	100	12·8	23·2	0 to 40
	0·1 N HCl in 70% methanol	20	6·0 to 2·0	1264	97	13·1		
	0·1 N HCl in 90% methanol	20	6·0 to 2·0	1250	101	12·4		
	0·1 N HCl in 98% methanol	20	4·5 to 2·0	1218	98	12·4		
	0·1 N HCl in 100% methanol	20	4·5 to 2·0	1216	104	11·8	20·6	−35 to 40
	0·1 N HCl in 100% methanol						19·2	−70 to −40
	0·01 to 0·54 N HCl in 100% ethanol	25	6·5 to 3·0	1250	120	10·2		
	2 to 4·5 N H_2SO_4 in 100% ether	20	4·7 to 3·5	1400	125	11·2		
Ni	0·08 N HCl in 100% ethanol	20	4·4 to 3·9	470	100	4·7		
	0·1 N NH_4Cl in liq NH_3	−50	7·0 to 3·8	740	90	8·2	7	

96 PARAMETERS FOR THE DEPOSITION OF METALS ON A SUBSTRATE OF THE SAME METAL AT ROOM TEMPERATURE FROM AQUEOUS SOLUTION

Metal	Solution	$-\log_{10}i_0$	α
Cu	1 M $CuSO_4$	4·7	0·5
Fe	1 M $FeSO_4$	8·0	0·5
Hg	10^{-3} M $Hg_2(NO_3)_2 + 2$ N $HClO_4$	0·7	0·6
Ni	1 M $NiSO_4$	8·7	0·5
Zn	1 M $ZnSO_4$	4·7	0·5

97 PARAMETERS FOR THE EVOLUTION OF VARIOUS GASES AT INERT ELECTRODES IN AQUEOUS SOLUTION

Gas	Metal	Solution	Temp.	$-\log_{10} i_0$	α
O_2	Pt	0·1 N H_2SO_4	22°C	9·7	0·59
	Pt	0·1 N NaOH		12·4	1·2
	Au	0·1 N NaOH		12·3	1·2
N_2	Pt	0·1 N NaN_3		76·	0·98
	Ir	0·1 N NaN_3		75·	1·0
	Pd	0·1 N NaN_3		81·	1·1
Cl_2	Pt	1 N HCl		2·3	0·48
	Ir	1 N HCl		4·4	0·73
Br_2	Ir	1 N KBr		2·5	0·6

$\alpha = RT/bF$. For definition of other symbols, see Table 82.

98 PARAMETERS FOR THE DEPOSITION OF METALS FROM 10^{-3} M AQUEOUS SALT SOLUTION IN 1 M SUPPORTING SOLUTION ON TO DILUTE AMALGAM AT 20°C

Metal	Solution	$-\log_{10} i_0$	$\Delta H_0^{\ddagger}$
Bi	$Bi(ClO_4)_2 + HClO_4$	4·1	10·0
Cd	$Cd(NO_3)_2 + KNO_3$	0·9	5·
Cs	CsOH + Me_4NOH	1·3	
Cu	$Cu(NO_3)_2 + KNO_3$	2·1	9·0
Na	NaOH + Me_4NOH	1·4	
Pb	$Pb(NO_3)_2 + KNO_3$	<0·7	
Tl	TlOH + KNO_3	<1·0	
Zn	$Zn(NO_3)_2 + KNO_3$	3·2	8·8

99 PARAMETERS FOR OXIDATION-REDUCTION REACTIONS AT ELECTRODES IN AQUEOUS SOLUTION

At Platinum electrodes				
Reaction	c_{reac}	**Base solution**	$-\log_{10} i_0$	α
$Ce^{4+} + e^- \rightleftharpoons Ce^{3+}$	10^{-3}	1 N H_2SO_4	4·36	0·75
	10^{-3}	1 N HNO_3	4·52	0·75
$Fe^{3+} + e^- \rightleftharpoons Fe^{2+}$	$1·5 \times 10^{-2}$	2 N H_2SO_4	2·3	0·58
$Mn^{3+} + e^- \rightleftharpoons Mn^{2+}$	10^{-2}	15 N H_2SO_4	5·0	0·72
At Mercury electrodes at 20°C				
Reaction	c_{reac}	**Base solution**	$-\log_{10} i_0$	$\Delta H_0^{\ddagger}$
$Cr^{3+} + e^- \rightleftharpoons Cr^{2+}$	10^{-3}	1 M KCl	6·02	
$Cr(CN)_6^{4-} + e^- \rightleftharpoons Cr(CN)_6^{5-}$	10^{-3}	1 M KCN	2·62	small
$Eu^{3+} + e^- \rightleftharpoons Eu^{2+}$	10^{-3}	1 M KCl	4·70	9·0
	10^{-3}	1 M KI	3·82	9·5
	10^{-3}	1 M KCNS	3·09	7·5
$Fe(C_2O_4)_3^{3-} + e^- \rightleftharpoons Fe(C_2O_4)_3^{4-}$	10^{-3}	½ M $K_2C_2O_4$	<1·0	
$Ti^{4+} + e^- \rightleftharpoons Ti^{3+}$	10^{-3}	1 M Tartaric	3·07	7·0
$V^{3+} + e^- \rightleftharpoons V^{2+}$	5×10^{-3}	1 M $HClO_4$	3·42	6·5
	5×10^{-3}	½ M $K_2C_2O_4$	4·89	5·5

c_{reac} is the concentration of each reactant in mole litre^{-1}.

100 SURFACE TENSION AND APPARENT RELATIVE SURFACE TENSION OF AQUEOUS SALT SOLUTIONS

σ = surface tension of solution, σ_0 = surface tension of pure solvent, in dyne cm^{-1}, temperature 25°C except where stated. c = molar concentration (moles solute per litre solution). m = molality (moles solute per 1000 g water).

$BaCl_2$		CsI		$CsNO_3$		KCNS	
c	σ_c/σ_0	c	σ_c/σ_0	c	σ_c/σ_0	c	σ_c/σ_0
0·00005	0·99990	0·00010	0·99995	0·00010	0·99992	0·00020	0·99992
0·00010	0·99985	0·00020	0·99986	0·00020	0·99990	0·00050	0·99989
0·00025	0·99984	0·00050	0·99984	0·00050	0·99986	0·00100	0·99986
0·00050	0·99982	0·00100	0·99987	0·00100	0·99983	0·00200	0·99980
0·00100	0·99984	0·00200	0·99991	0·00200	0·99986	0·00500	0·99986
0·00250	0·99994	0·00500	0·99998	0·00500	0·99996	0·01000	1·00002
0·00500	1·00016	0·01000	1·00010	0·01000	1·00013	0·02000	1·00013
0·01000	1·00047	0·02000	1·00038	0·02000	1·00046	0·05000	1·00037
0·02500	1·00126	0·05000	1·00101	0·05000	1·00118	0·10000	1·00079
0·05000	1·00254	0·10000	1·00193	0·10001	1·00217	0·20000	1·00144
0·10000	1·00484	0·20000	1·00361			0·50000	1·00284
0·25000	1·01117					0·99937	1·00575
0·50121	1·02174					2·00000	1·01322
1·00800	1·04440					4·99412	1·05202

KCl		$KClO_3$		$K_4Fe(CN)_6$		$K_3Fe(CN)_6$	
c	σ_c/σ_0	c	σ_c/σ_0	c	σ_c/σ_0	c	σ_c/σ_0
0·00010	0·99997	0·00010	0·99992	0·00005	0·99992	0·000033	0·99994
0·00020	0·99995	0·00020	0·99987	0·00010	0·99987	0·000067	0·99993
0·00050	0·99983	0·00050	0·99984	0·00020	0·99984	0·000167	0·99992
0·00100	0·99982	0·00100	0·99984	0·00050	0·99994	0·000333	0·99990
0·00200	0·99988	0·00200	0·99986	0·00100	1·00003	0·000667	0·99991
0·00500	0·99998	0·00500	0·99998	0·00200	1·00014	0·001667	1·00004
0·01000	1·00013	0·01000	1·00011	0·00500	1·00048	0·00333	1·00014
0·02000	1·00047	0·02000	1·00022	0·01000	1·00090	0·00667	1·00053
0·05000	1·00143	0·05000	1·00066	0·02000	1·00169	0·01667	1·00126
0·10000	1·00273	0·10000	1·00132	0·05000	1·00376	0·03333	1·00235
0·20000	1·00514	0·20000	1·00254	0·09940	1·00672	0·06667	1·00430
0·50000	1·01197	0·50000	1·00558	0·19881	1·01232	0·16667	1·00986
0·99996	1·02299			0·50058	1·02953	0·33333	1·01875
1·99908	1·04531					0·66667	1·03847
2·99647	1·06894					1·00000	1·06172
						1·16667	1·07469

Table 100 (*cont.*)

K_2SO_4		LiF		$LaCl_3$		$MgSO_4$	
c	σ_c/σ_0	*c*	σ_c/σ_0	*c*	σ_c/σ_0	*c*	σ_c/σ_0
0·00020	0·99995	0·00010	0·99994	0·00005	0·99985	0·00010	0·99997
0·00040	0·99991	0·00020	0·99992	0·00010	0·99984	0·00020	0·99994
0·00100	0·99988	0·00050	0·99988	0·00025	0·99981	0·00050	0·99993
0·00200	0·99982	0·00100	0·99988	0·00050	0·99985	0·00100	0·99997
0·00400	0·99993	0·00200	0·99992	0·00100	0·99987	0·00200	1·00003
0·01000	1·00019	0·00500	1·00000	0·00250	1·00004	0·00500	1·00022
0·02000	1·00058	0·01000	1·00026	0·00500	1·00028	0·01000	1·00046
0·04000	1·00110	0·02000	1·00056	0·01000	1·00068	0·02000	1·00087
0·10000	1·00262	0·03000	1·00086	0·02500	1·00176	0·05000	1·00195
0·19993	1·00460			0·05000	1·00324	0·10000	1·00345
0·40015	1·00850			0·10000	1·00625	0·20000	1·00638
1·00142	1·01956			0·25000	1·01496	0·49647	1·01435
				0·50000	1·03045	1·00000	1·02836
				1·00000	1·06733	1·98720	1·06603

NaCl		$ThCl_4$		$Al_2(SO_4)_3$		$HClO_4$			
							σ_c		
c	σ_c/σ_0	*c*	σ_c/σ_0	*m*	σ_c	c^a	15°C	25°C	50°C
0·00010	0·99995	10^{-9}	0·99997	0·1	72·32	0·0	73·51	71·97	68·16
0·00020	0·99990	10^{-8}	0·99994	0·2	72·92	4·86	72·52	71·18	67·60
0·00050	0·99991	10^{-7}	0·99996	0·3	73·51	10·01	71·66	70·34	66·97
0·00100	0·99990	10^{-6}	0·99995	0·4	74·11	20·38	70·46	69·21	66·12
0·00200	0·99997	2×10^{-6}	0·99995	0·5	74·71	30·36	69·82	68·57	65·66
0·00500	1·00014	3×10^{-6}	1·00000	0·6	75·30	40·37	69·72	68·49	65·74
0·01000	1·00034	5×10^{-6}	0·99992	0·7	76·06	53·74	70·33	69·02	66·60
0·02000	1·00068	10^{-5}	0·99988	0·8	77·07	60·70	70·88	69·69	67·40
0·05000	1·00153	5×10^{-5}	0·99987	0·9	78·30	63·47	70·77	69·73	67·44
0·10000	1·00280			1·0	79·73	67·59	70·67	69·71	67·41
0·20000	1·00538					70·43	70·07	69·54	67·26
0·50000	1·01254					72·25	69·96	69·01	66·85
0·99998	1·02421								
1·99962	1·04819								

[a] The concentration of perchloric acid is expressed as weight %

101 DIELECTRIC CONSTANT OF AQUEOUS SOLUTIONS AT 25°C

$\epsilon = 78{\cdot}54 - 2Ac$
(valid $c = 0{\cdot}5 - 2{\cdot}0$)

Solute	*A*	Solute	*A*
HCl	10	NaI	7·5
LiCl	7	KI	8
NaCl	5·5	$MgCl_2$	15
KCl	5	$BaCl_2$	14
RbCl	5	$LaCl_3$	22
NaF	6	NaOH	10·5
KF	6·5	Na_2SO_4	11

102 EQUIVALENT REFRACTION R_l (D-LINE) OF IONS IN INFINITELY DILUTE AQUEOUS SOLUTION AT 25°C

Calculated assuming that $R_l = 0{\cdot}200$ cm³ mole⁻¹ for the sodium ion

Ion	R_l	Ion	R_l	Ion	R_l
Ag^+	4·79	$\frac{1}{3}In^{3+}$	0·10	Br^-	12·67
$\frac{1}{3}Al^{3+}$	−0·83	K^+	2·26	CN^-	8·34
$\frac{1}{2}Ba^{2+}$	2·19	$\frac{1}{3}La^{3+}$	0·46	$\frac{1}{2}CO_3^{2-}$	6·07
$\frac{1}{2}Ca^{2+}$	0·36	Li^+	−0·32	Cl^-	9·06
$\frac{1}{2}Cd^{2+}$	1·16	$\frac{1}{2}Mg^{2+}$	−0·79	ClO_4^-	13·24
$\frac{1}{2}Co^{2+}$	0·64	$\frac{1}{2}Mn^{2+}$	0·69	$\frac{1}{2}CrO_4^{2-}$	13·40
Cs^+	6·54	NH_4^+	4·32	F^-	2·61
$\frac{1}{2}Cu^{2+}$	0·20	Na^+	0·20	$HCOO^-$	9·88
$\frac{1}{2}Fe^{2+}$	0·61	$\frac{1}{2}Ni^{2+}$	0·34	I^-	19·22
$\frac{1}{3}Fe^{3+}$	0·95	Rb^+	3·79	IO_3^-	19·45
H^+	−0·52	$\frac{1}{2}Sr^{2+}$	0·95	NO_3^-	11·02
$\frac{1}{2}Hg^{2+}$	2·80	$\frac{1}{2}Zn^{2+}$	0·31	OH^-	5·15
				$\frac{1}{2}SO_4^{2-}$	7·36
				$\frac{1}{2}SiO_3^{2-}$	6·69

103 PROPERTIES OF INORGANIC COMPOUNDS AND MOLTEN SALTS

Temperatures (°C) are given in round brackets following values. Square brackets indicate extrapolated values

Substance	M.p. °C	B.p. °C	Density $d_t = a - bt \times 10^{-3}$ (g/cm³)		Electrical conductivity[c] (Ω cm)⁻¹							
			a	b	at m.p.	at temp. t	t °C	at $t+50$	at $t+100$	at $t+150$	at $t+200$	at $t+250$
A	−189·2	−185·6	1·398	(b.p.)								
AgBr	430	1540	6·025	1·04	2·95	3·1	500	3·15	3·25	3·25	3·4	3·5
AgCl	455	1564	5·264	0·93	3·82	3·98	500	4·16	4·34	4·50	4·66	4·79
$AgClO_3$	231		4·263	1·742	0·417	0·474	250					
AgI	557	1506	6·139	1·01	2·3	2·35	600	2·40	2·45	2·5	2·55	
$AgNO_3$	210		4·167	1·00	0·660	0·840	250	1·051	[1·25]			
$Al(BH_4)_3$	−64	45·9										
$AlBr_3$	97	255	2·875	2·314	[$<10^{-8}$]	[$0{\cdot}02.10^{-6}$]	150	0·10	0·19	[0·26]		
$AlCl_3$	193	1805	1·805	2·5	$4{\cdot}6.10^{-7}$	$5{\cdot}5.10^{-7}$	200	11·1				
AlI_3	191	385	3·70	2·5	[$1{\cdot}2.10^{-6}$]	$1{\cdot}9.10^{-6}$	200	5·7	7·1			
$AsBr_3$	31	220	3·455	2·6		$2{\cdot}6.10^{-7}$	35					
$AsCl_3$	−16	130	2·205	2·18	$1{\cdot}0.10^{-7}$							ε12·8(20)[c]
AsF_3	−13	63	3·01(25)[a]		$1{\cdot}56.10^{-5}$	$1{\cdot}84.10^{-5}$	0	2·92				
AsF_5	−80	−53	2·047	5·34								
AsH_3	−166·3	−62·4	1·413	3·602[b]								ε2·58(−50)
AsI_3	142	412			Poor							
BBr_3	−46	91·5	2·650	(0)								ε2·16(15)[d]
BCl_3	−107	12·5	1·349	(11)	Non-cond.							
BF_3	−126·7	−99·1	1·143	4·45		$<5{\cdot}0.10^{-7}$	−120					
B_2H_6	−165·7	−92·5	0·314	1·296								
BI_3			3·3	(50)								
B_2O_3	570		1·633	0·125		$0{\cdot}3.10^{-5}$	750	0·85	1·45	2·1	3·3	4·5
$(BHNH)_3$	−58	55	0·861	0·97								
$BaCl_2$	960		3·71	0·6	1·94	2·06	1000	2·20	2·32			
$BeCl_2$	405	488	1·976	1·1		$2{\cdot}9.10^{-3}$	450	8·3(470)				
BeO	2530	4120										
$BiBr_3$	218	461	5·248	2·6								
$BiCl_3$	230	441	4·438	2·29	[0·395]	[0·42]	250	0·487	0·554	[0·60]		
Br	−7·2	58·8	3·1023	(25)[e]								ε3·2(23)
BrF_3	8·8	127	2·867	2·77								
BrF_5	−61·3	40·5	2·551	3·46								
CBr_4	91·0	189·5										
CCl_4	−22·96	76·7	1·633	1·925		ε2·2930	−10	2·273(0)	2·245(15)	2·227(25)	2·183(50)	2·148(50)
CF_4	−183·7	−128										
C_2N_2	−27·1[f]	−21·3	0·9151	1·857								
CNBr	51·3	61·3	2·0246	2·632								
CNCl	−6·5	12·6	1·2223	2·049								
CO	−205·1	−191·5	0·793	(b.p.)								
CO_2	−56·6	−78·55	0·926	7·60								
$COCl_2$	−127	8·2	1·435	2·38								
COF_2	−114·0	−83·3	0·662	4·20								
COS	−138·2	−50·2	1·049	2·9								
COSe	−122·2	−22·9	1·811	(4)								
CS_2	−111·5	46·3	1·2927	1·481[g]		ε2·6858	−20	2·658(0)	2·644(10)	2·632(20)	2·617(30)	2·603(40)
$CaCl_2$	782		2·412	0·45	1·93	1·99	800	2·18	2·36	2·55	2·74	
CaF_2	1418	2500										

[a] $d_t = 2{\cdot}6659 - 3{\cdot}839 \times 10^{-3}t + 4{\cdot}35 \times 10^{-6}t^2$ $(0 < t < 60°C)$.

[b] $d_t = 1{\cdot}413 - 3{\cdot}602 \times 10^{-3}t - 4{\cdot}321 \times 10^{-6}t^2$ $(-11 < t < -64°C)$.

[c] Where substance is non-conducting values of dielectric constant are given with prefix ε.

[d] $d\epsilon/dt = -0{\cdot}028$ $(-47 < t < 80°C)$.

[e] $d_{b.p.} = 2{\cdot}95$.

[f] Second form has m.p. −27·95°C.

[g] $d_t = 1{\cdot}2927 - 481 \times 10^{-3}t - 30{\cdot}6 \times 10^{-8}t^2$.

103 PROPERTIES OF INORGANIC COMPOUNDS AND MOLTEN SALTS (*cont.*)

Temperatures (°C) are given in round brackets following values. Square brackets indicate extrapolated values

Substance	M.p. °C	B.p. °C	Density $d_t = a - bt \times 10^{-3}$ (g/cm³)		Electrical conductivity[c] (Ω cm)⁻¹							
			a	b	at m.p.	at temp. *t*	*t* °C	at *t*+50	at *t*+100	at *t*+150	at *t*+200	at *t*+250
$CdBr_2$	565	863	4·688	1·08		1·07	600	1·25(640)				
$CdCl_2$	568	967	3·870	0·84	1·87	1·96	600	2·09	2·20	2·30	2·37	[2·44]
CdF_2	1110	1750										
CdI_2	390	796										
Cl_2	−101·5	−34·6	1·56	(b.p.)								
$CoCl_2$	740	1025										
$CrCl_2$	815	1304										
$CsBr$		1300	3·997	1·342								
$CsCl$	646	1300	3·489	1·08	1·103	1·113	650	1·229	1·335	1·427	1·512	
CsF		1251	4·475	1·234								
CsI		1280	3·953	1·215								
$CsNO_3$	417	2	3·270	1·114	[0·550]	0·599	450	0·671	0·740	[0·806]		
Cs_2SO_4			3·867	0·8								
Cu_2Cl_2	430	1490	4·010	0·79	3·25	3·31	450	3·44	3·57	3·69		
Cu_2S	1130				76·9	88·3	1250	94·1	100·7	108·2	117·1	127·2
D	−254·6	−249·6	0·171	(−253)								
DBr		−66·9										
DCN		25·9										
DCl		−81·6										
DF		18·3										
DI		36·2										
D_2O	3·82	101·4	1·101	(25)								
D_2S	−86·0											
F	−218	−188·0	1·108	(b.p.)								
$Fe(CO)_5$	−21	105·0										
$FeCl_3$	304	~319										
$GaBr_3$	125		3·507	2·95	$5{\cdot}0.10^{-8}$							
$GaCl_2$	175				Good							
$GaCl_3$	77		2·223	20·5	$\sim10^{-8}$							
GaI_3	211		4·073	2·24	$1{\cdot}6.10^{-4}$							
$GeBr_4$		189										
$GeCl_4$		84										
GeH_4	−165	−90	1·532	(−142)								
H	−257·1	−252·8										
HBr	−88·5	−67·0										
HCN	−13·4	25·7	0·7205	1·45								
HCl	−112	−83·7										
HF	−82·3	19·5	1·002	2·263 [h]								
HI	−50·8	−35·4										
H_2O_2	−0·89	151·0										
H_2S	−85·49	−60·3										
H_2S_2	−89·6	70·7	1·334	(20)								
H_2Se	−65·7	−41·2	2·12	(b.p.)								
H_2Te	−57	0·0	2·65	(b.p.)								
$HgBr_2$	238	319	5·928	3·38	$1{\cdot}5.10^{-3}$							
Hg_2Cl_2	525		8·00	4·0	1·00	1·03	550					
$HgCl_2$	277	304	5·021	2·218	$7{\cdot}7.10^{-4}$	$8{\cdot}0.10^{-4}$	300					
HgI_2	250 [i]	354	6·060	3·22		$3{\cdot}05.10^{-2}$	275					
ICl	27·2	100	3·186	3·0								
IF_5	9·6	98	4·38	4·0								

[h] $d_t = 1{\cdot}002 - 2{\cdot}263 \times 10^{-3}t + 3{\cdot}13 \times 10^{-6}t^2$

[i] Yellow form; red form melts 256°.

103 PROPERTIES OF INORGANIC COMPOUNDS AND MOLTEN SALTS (*cont.*)

Temperatures (°C) are given in round brackets following values. Square brackets indicate extrapolated values

Substance	M.p. °C	B.p. °C	Density $d_t = a - bt \times 10^{-3}$ (g/cm³)		Electrical conductivity[c] (Ω cm)⁻¹							
			a	b	at m.p.	at temp. *t*	*t* °C	at *t*+50	at *t*+100	at *t*+150	at *t*+200	at *t*+250
$InBr_3$	436	371 s	3·674	1·5	0·168	0·167	450	0·162	0·156			
$InCl$	225	608	4·055	1·4	0·88	1·04	250	1·33	1·62	[1·89]		
$InCl_2$	235		3·43	1·6	0·23	0·26	250	0·36	0·46	0·56	0·64	0·72
$InCl_3$	498	498 s	3·37	2·1	[0·50]	[0·50]	500	[0·46]	0·41	0·37	0·32	[0·28]
InI_3	210		4·135	1·5	$5{\cdot}2.10^{-2}$	$6{\cdot}6.10^{-2}$	250	8·0	9·2	[10·0]		
KBr	742	1383	2·708	0·8	1·59	1·61	750	1·74	1·85	[1·94]		
KCl	770	1407	1·956	0·565	2·17	2·36	850	2·47	2·57	2·65	2·73	2·79
$KClO_3$	368				4·19							
K_2CO_3	895		2·314	0·46	1·93	1·95	900	2·12	2·26			
$K_2Cr_2O_7$	398		2·564	0·698	0·200	0·204	400	0·298	0·389	[0·474]		
KF	857	1502	2·477	0·666	3·2	3·4	400	3·6	3·8			
$KHSO_4$	212		2·232	0·767	0·049	0·141	301					
KI	682	1324	3·159	1·04	[1·30]	1·34	700	1·43	1·53			
KNH_2	330					0·389	340					
KNO_3	337		2·123	0·755	0·624	0·664	350	0·816	0·967	1·112		
KOH	410		1·893	0·44								
K_2SO_4	1069		2·472	0·545	[1·78]	1·84	1100	1·94				
K_2WO_4			3·871	0·76								
Kr	−157·3	−152·3	2·16	(b.p.)								
$LaCl_3$	885		3·585	0·5	1·20	1·25	900	1·40	1·54	[1·64]		
$LiBr$	550	1310	2·93	0·7	4·63	4·91	500					
$LiCl$	614	1382	1·762	0·432	5·81	5·97	650	6·16	6·37	6·58	6·76	[6·93]
Li_2CO_3			2·071	0·34								
LiF	870	1681	2·201	0·474	18·4	20·0	900	23·4	27·7			
$LiNO_3$	254		1·924	0·548	0·82	1·06	300	1·33	1·59	1·86		
Li_2SO_4			2·346	0·402								
$MgCl_2$	714	1418	1·88	0·29	1·00	1·08	750	1·18	1·28	1·38	1·47	1·55
$MOCl_5$	194	268				$0{\cdot}3.10^{-6}$	200	6·3				
MoF_6	17·5	35	2·637	4·91								
N	−210·0	−195·81	1·1604	4·55k								
NH_3	−77·8	−33·4	0·6420	1·19								
NH_4HSO_4	145				0·079	0·086	150	0·154				
NH_4NO_3	169·6				0·31	0·41	200	[0·53]				
N_2H_4	1·8	113·5	1·0114	(15)								
N_2O	−90·8	−88·5	1·2257	(b.p.)								
NO	−163·7	−151·8	1·269	(b.p.)								
NO_2	−11·3	21·1	1·474	(15)								
$NOCl$	−59·6	−6·4	1·417	(−12)								
NO_2Cl	−145	−15·9										
NOF	−132·5	−59·9	1·919	2·78								
NO_2F	−166	−72·4	2·143	3·23								
Na_3AlF_6	1012		3·036	0·94	2·83	2·80 l	1000	2·925	3·05			
$NaBr$	755	1392	2·927	0·795	[2·8]	3·06	800	3·23	3·30			
$NaCl$	800	1465	1·961	0·52	3·51	3·69	850	3·86	4·02	4·16	4·29	4·39
Na_2CO_3	850		2·305	0·4	2·7	2·9	900	3·0				
NaF	992	1704	2·577	0·62	5·46	5·50	1000	5·77	6·04			
NaI	655	1304	3·441	1·061	[2·50]	2·56	700	2·63	2·70	2·76	2·83	2·90
Na_2MoO_4	687		3·235	0·629	[1·02]	1·42	850	1·53	1·63	1·72	1·81	1·90 m
$NaNO_3$	310		2·116	0·67	0·99	1·160	350	1·364	1·550	1·724	[1·88]	
$NaOH$	322		1·940	0·485	2·14	2·38	350	2·82	3·27			
$NaPO_3$	625		2·545	0·44	0·36	0·675	750	0·80	0·925	1·05	1·175	1·30
Na_2SO_4	885		2·495	0·48	[2·19]	2·23	900	2·37	2·50	2·64	2·77	[2·91]
Na_2WO_4	696		4·827	1·554 n	[0·97]	1·19	800	1·29	1·39	1·50	1·60	1·70 o
$NbCl_5$	205	250				$0{\cdot}22.10^{-6}$	228					
$NdCl_3$	761				[0·587]	0·692	800	0·821	0·945	[1·058]		
Ne	−248·7	−246·0	1·204	(b.p.)								
$Ni(CO_4)$	−25	43	1·3561	2·213 p								

k $d_T = 1{\cdot}1604 - 4{\cdot}55 \times 10^{-3}T$ where T is in °K.

l molten.

m 2·07 at 1200°, 2·22 at 1300°, 2·37 at 1400°.

n $+3{\cdot}37 \times 10^{-7}t^2$ (range 750 to 1500°).

o 1·98 at 1200°, 2·15 at 1300°, 2·31 at 1400°, 2·45 at 1500°.

p $-4 \times 10^{-6}t^2$ (range 0 to 36°).

103 PROPERTIES OF INORGANIC COMPOUNDS AND MOLTEN SALTS (*cont.*)

Temperatures (°C) are given in round brackets following values. Square brackets indicate extrapolated values.

Substance	M.p. °C	B.p. °C	Density $d_t = a - bt \times 10^{-3}$ (g/cm³)		Electrical conductivity [c] $(\Omega\ \text{cm})^{-1}$							
			a	b	at m.p.	at temp. t	t °C	at $t+50$	at $t+100$	at $t+150$	at $t+200$	at $t+250$
O_2	−218·8	−183·01	1·5760	4·81 [q]								
O_3	−249·6	−111·5	1·71	(−183)								
OF_2	−223·8	−144·8	0·8498	4·695								
OsF_8	34·4	47·5	2·74	(47·5)								
OsO_4	56 [r]	130·0	4·504	4·17								
P_4	44·1 [s]	280	1·745	(44·5)								
PBr_3	−40	175·3	2·924	2·48								
PCl_3	−111·8	74·2	1·612	1·86								
PCl_5	148 [t]	160 [s]	1·903	1·9								
PH_3	−133·8	87·8	0·855	0·595 [q]								
P_2O_3	23·8	175·4	1·6897	(b.p.)								
$POCl_3$	1·25	105·1	1·6861	(15)								
$PbBr_2$	370	914	6·338	1·65	[0·57]	0·677	400	0·851	1·011	[1·153]		
$PbCl_2$	498	954	5·702	1·5	1·44	1·44	500	1·70	1·92	2·13	2·33	[2·54]
$PbCl_4$	−15		3·18	(0)		$8·0.10^{-7}$	0					
$PrCl_3$	823				0·81	0·89	850	1·05	1·21	1·37		
RbBr	682	1352	3·460	1·1								
RbCl	717	1381	2·873	0·87	1·46	1·54	750	1·67	1·77	1·85	[1·91]	
RbF		1408	3·707	1·011								
RbI	641	1304	3·577	1·11								
$RbNO_3$	316		2·782	0·97	0·431	0·507	350	0·618	0·721	0·817	[0·906]	
Rb_2SO_4			3·260	0·665								
ReF_6	19·0	48·0	3·805	8·615								
Re_2O_7	304	350	4·30	(331)								
S	119·0 [u]	444·60	1·804	(126·7)	$1·1.10^{-12}$	$3·6.10^{-9}$	300					
S_2Cl_2	−80	138	1·710	1·57								
SCl_2	∼−70	59	1·621	(15)								
SF_6	−50·4	−63·75	1·85	(m.p.)								
$SOCl_2$	−104·5	78·8	1·677	1·97								
SO_2	−75·46	−10·02	1·5106	(−20)								
SO_2Cl_2	−46	69·3	1·708	2·11								
SO_3	16·7 [v]	44·5	1·8124	(b.p.)								
$SbBr_3$	97	288	3·691	(b.p.)	$2·28.10^{-7}$	$2·36.10^{-7}$	100	3·55	4·50			
$SbCl_3$	73·5	219	2·849	2·268	$5·0.10^{-7}$							
$SbCl_5$	4	[172] [w]	2·392	2·04								
SbF_5	6		2·993	(22·7)	$0·4.10^{-8}$	$5·85.10^{-8}$	50	41·0 [r]				
SbH_3	−88	−17·1	2·150	3·2								
SbI_3	170	401			$3·18.10^{-8}$	$3·19.10^{-8}$	200	4·83	5·68	6·44	[7·11]	
$ScCl_3$	960	967	1·63	(1000)	0·56	0·63	980					
SeF_4	−9·5	108	2·733	(25)								
SeF_6	−34·7	−46·65	2·26	(m.p.)								
SeOC	−122·2	−22·9	1·811	(4)								
$SeOCl_2$	10·9	179	2·478	2·08								
$SiBr_4$	5·2	154·6	2·812	2·63								
$SiCl_4$	−70·4	56·9	1·523	2·08								
SiF_4	−90	−95·15	1·224	4·651								
SiH_4	−182	−112	0·68	(−185)								

[q] $d_T = a - b \times 10^{-3} T$ where T is in °K.

[r] At 80°.

[s] Measured against its vapour.

[t] <1 atm.

[u] Usual m.p. (monoclinic solid to pure λ liquid); usual f.p. 114·5° (equilibrium S_λ and S_π to monoclinic). Rhombic to pure S_λ. 112·8°; equilibrium S_λ and S_π to rhombic solid 110·1°.

[v] For γ form: α form melts at 62·2°, β form at 32·5°.

[w] Yellow form: white form melts at 42°.

103 PROPERTIES OF INORGANIC COMPOUNDS AND MOLTEN SALTS (*cont.*)

Temperatures (°C) are given in round brackets following values. Square brackets indicate extrapolated values

Substance	M.p. °C	B.p. °C	Density $d_t=a-bt\times10^{-3}$ (g/cm³)		Electrical conductivity[c] $(\Omega\ \text{cm})^{-1}$							
			a	b	at m.p.	at temp. t	t °C	at $t+50$	at $t+100$	at $t+150$	at $t+200$	at $t+250$
$SnCl_2$	247	652	3·679	1·22	0·79	0·81	250	1·11	1·39	1·66	[1·91]	
$SnCl_4$	−36·2	113·9	2·273	2·62								
SnI_4	145	348	4·145	2·45								
$SrCl_2$	872		3·095	0·45	1·89	1·98	900	2·14	2·29	2·43	2·56	
$TaCl_5$	221					3.10^{-7}	235					
$TeCl_2$	175				$[0{\cdot}5.10^{-2}]$	$3{\cdot}4.10^{-2}$	200	8·9	14·5			
$TeCl_4$	224	390	2·965	1·64	0·100	0·131	250	0·186				
TeF_6			2·442	6·02								
$ThCl_4$	770				[0·54]	[0·61]	800	0·71		0·86		
$TiCl_4$	−24·8	136	1·7614	1·72								
TlBr	460				0·807	0·905	500	1·024	1·127			
TlCl	430		6·402	1·80	1·088	1·164	450	1·350	1·532	1·700	[1·865]	
TlI	440				[0·371]	0·551	450	0·651	0·747	0·840	[0·927]	
$TlNO_3$	206		5·312	1·95	0·530	0·576	250	0·596				
UCl_4	567				0·33	0·43	600	[0·56]				
WCl_6	275	346			$1{\cdot}86.10^{6}$	$2{\cdot}60.10^{-6}$	300	6·94 x				
WF_6	2·3	17·5	3·528	5·84								
Xe	−140	−109·1	3·06	(b.p.)								
YCl_3	721		2·87	0·5	0·42	0·48	750	0·58	0·69	0·79		
$ZnCl_2$	331		2·743	7·42 y	$0{\cdot}2.10^{-2}$	$1{\cdot}4.10^{-2}$	400	4·1	8·7	15·7	23·6	31·6

x at 330°.

y $+2{\cdot}5\times10^{-7}t^2$.

104 ELECTRICAL AND MAGNETIC UNITS

System	Fundamental units chosen					Relationship with mechanical units (*in vacuo*)			Constants[a]				
	l	m	t	κ_0	μ_0	Coulomb's law $F=Q_1Q_2/\alpha k_0r^2$	Coulomb's law $F=M_1M_2/\beta\mu_0r^2$	Ampère's law $F=-2\gamma^2\beta\mu_0I_1I_2\mathrm{d}S_1\mathrm{d}S_2/r^2$	α	β	γ	κ_0[b, c, e, f]	μ_0[b, c, e, f]
Gaussian (G)	cm	g	sec	1		$f=q_1q_2/k_0r^2=q_1q_2/r^2$			1			1*st* F/cm	
	cm	g	sec		1		$f=m_1m_2/\mu_0r^2$ $=m_1m_1/r^2$	$f=2i_1i_2\mu_0\mathrm{d}s_1\mathrm{d}s_2/r^2$		1	1		1*ab*H/cm
Maxwell (electrostatic)	cm	g	sec	1		$f=q_1q_2/k_0r^2=q_1q_2/r^2$	$f=m_1m_2/\mu_0r^2$ $=m_1m_2c_c^2/r^2$	$f=-2i_1i_2\mu_0\mathrm{d}si\mathrm{d}s_2/r^2$ $=-2i_1i_2\mathrm{d}s_1\mathrm{d}s_2/c_c^2r^2$	1	1	1	1*st* F/cm	$1/c_c^2$ *st* H/cm
Electromagnetic (see absolute units 1.5)	cm	g	sec		1	$f=q_1q_2/k_0r^2=q_1q_2c_c^2/r^2$	$f=m_1m_2/\mu_0r^2$ $=m_1m_2/r^2$	$f=-2i_1i_2\mu_0\mathrm{d}s_1\mathrm{d}s_2/r^2$ $=-2i_1i_2\mathrm{d}s_1\mathrm{d}s_2/r^2$	1	1	1	$1/c_c^2$ *ab* F/cm	1*ab* F/cm
Heaviside-Lorentz (h.l.s.)	cm	g	sec	1		$f=q_1q_2/4\pi k_0r^2$ $=q_1q_2/4\pi r^2$	$f=m_1m_2/4\pi\mu_0r^2$ $=m_1m_2c_c^2/4\pi r^2$	$f=-i_1i_2\mu_0\mathrm{d}s_1\mathrm{d}s_2/2\pi r^2$ $=-i_1i_2\mathrm{d}s_1\mathrm{d}s_2/2\pi c_c^2r^2$	4π	4π	$1/4\pi$	1*st* F/cm	$1/c_c^2$ *st* H/cm
Giorgi (M.K.S.)[d]	m	kg	sec		10^{-7}	$F=Q_1Q_2/k_0r^2$ $=Q_1Q_2c_m^2/r^2\times10^{-7}$	$F=M_1M_2/\mu_0r^2$ $=M_1M_2/r^2\times10^7$	$F=-2I_1I_2\mu_0\mathrm{d}S_1\mathrm{d}S_2/r^2$ $=-2I_1I_2\mathrm{d}S_1\mathrm{d}S_2/r^2\times10^{-7}$	1	1	1	$10^7/c_m^2$ F/m	$1/10^7$ H/m
Rationalized Giorgi (M.K.S.)	m	kg	sec		$\frac{4\pi}{10^7}$	$F=Q_1Q_2/4\pi k_0r^2$ $=Q_1Q_2c_m^2/r^2\times10^{-7}$	$F=M_1M_2/4\pi\mu_0r^2$ $=M_1M_2/(4\pi r)^2\times10^7$	$F=I_1I_2\mu_0\mathrm{d}S_1\mathrm{d}S_2/2\pi r^2$ $=-I_1I_2\mathrm{d}S_1\mathrm{d}S_2/r^2\times r^2\times10^{-7}$	4π	4π	$1/4\pi$	$10^7/4\pi c_m^2$ F/m	$4\pi/10^7$ H/m

[a] For compatible systems $\alpha\beta\gamma^2c^2\mu_0\kappa_0=1$.

[b] $c_c=3\times10^{10}$ [cm/sec]; $c_m=3\times10^8$ [m/sec].

[c] *st* F = electrostatic unit of capacity; *st* H = electrostatic unit of inductance.

[d] Adopted by International Electrotechnical Commission, 1935; recommended by Advisory Committee on Electrical and Magnetic Magnitudes (I.E.C.), 1938, μ_0 be defined as 10^{-7} H/m.

[e] *ab* F, *ab* H = electromagnetic units of capacity and inductance.

[f] F = farad; H = henry.

Table 104 (*cont.*)

A minimum of four fundamental units from which all others may be derived is required to describe numerically the physical concepts of electricity. A further fundamental unit is needed for magnetic quantities or, alternatively, a theory relating electric and magnetic quantities may be accepted so that a system based upon the electrical units is used for magnetic measurements. The definition of electrical fundamental units has been a matter of some controversy but, in principle, the choice is as simple and as arbitrary as in other fields.

Originally, convenient values for units for the most used electrical measurements were chosen arbitrarily. Gauss and later Weber showed that systems of electrical units could be based upon the mechanical fundamental units. Gauss proposed a system for electrical units developed from the force of attraction between two-point charges *in vacuo*. $F \propto -q_1 q_2/r^2$. Thus electric charge (q) could be defined in terms of force (F) and distance (r) by choosing a suitable value for the constant of proportionality. This constant was chosen by Gauss to be 1; others have chosen other values. If a material other than vacuum exists between the two charges, then the attractive force will be different: $F \propto -q_1 q_2/\kappa_m r^2$ where κ_m is the permittivity of the material. In the gaussian system of units $F = -q_1 q_2/\kappa_m r^2$ and the permittivity of free space $\kappa_0 = 1$. If, however, the choice of constant is other than 1 the following questions must arise: Has a constant of proportionality only been defined? Has an arbitrary value been chosen for the permittivity of free space? Exactly the same considerations apply to the permeability of free space in defining magnetic or electromagnetic units. The matter has not been satisfactorily resolved, although the International Electrotechnical Commission has chosen to assign arbitrary values to the permittivity and permeability of free space. As a result magnetic induction and magnetic field, for example, are measured respectively in gauss and oersted, although in the gaussian system the units are identical and the values the same *in vacuo*. In other systems (*e.g.* m.k.s.) the units are different and the values are *not* coincident in free space.

The method employed here is to use the constant α in defining quantity of electricity and β in defining magnetic pole. α and β may be treated either as constants of proportionality or as the arbitrarily chosen value of the permittivity and permeability of free space. In this latter case κ_m is then the relative permittivity.

The electromagnetic system of units is defined by Ampère's law. The unit of current is the fundamental unit. The force of attraction between two parallel conductors of length ds_1, ds_2, distance r apart, carrying currents I_1 and I_2 is $dF \propto -2\mu I_1 I_2\, ds_1 ds_2/r^2$. Again, a constant of proportionality must be chosen. If this constant is chosen as unity then the electromagnetic system based on current as fundamental unit is compatible with the gaussian magnetic system with $\beta = 1$ and magnetic pole as fundamental unit. Because of the need for compatibility between electromagnetic and magnetic systems, the constant β may be introduced in Ampère's law, which can be written in general form $dF = -2\gamma^2 \beta \mu I_1 I_2\, ds_1 ds_2/r^2$ where γ is a constant of the system of units.

Rationalization—Many of the equations based on the gaussian or m.k.s. systems contain the constant 4π. Heaviside and later Giorgi proposed 'rationalized' systems of units in which the constant 4π is removed from certain equations by suitable definition of the units. It is not possible to remove 4π from all equations, but its appearance can be limited to expressions concerning spherical problems.

Practical units—Practical units of electrical measurement are based on multiples of the electromagnetic gaussian system chosen to give units of more convenient size.

International units—The 'international' units are now no longer officially in use. They were based upon physical standards made necessary by experimental difficulties in accurate determination of electrical units in terms of mechanical units.

ERRATA

Page viii.	Table 90. For 'Half-wane Potentials' read 'Half-wave Potentials'.
Page 12.	Reference to permission for reproduction applies to Table 9 on page 10 and not to Table 12.
Page 19.	Under Table 17 the term 'κ^{-1}' to the left of the equals sign should read 'k^{-1}'.
Page 20.	In the column 0·4M against $BeSO_4$ the value '0·079' should read '0·0769'.
Page 26.	The formulae 6 and 7 lines from the bottom of the table should read '$(NaOOC.CH)_2$ (cis)' and '$(NaOOC.CH)_2$ (trans)' respectively.
Page 35.	$\bar{C}_{p_2}$ = Partial molal heat capacity of solute (cal mole^{-1} deg^{-1}).
	$\bar{C}^0_{p_2}$ = Partial molal heat capacity of solute at infinite dilution (cal mole^{-1} deg^{-1}).
Page 46.	The equation for values marked E is '$\log_{10} K = -A/T + B \log_{10} T + C$.'
Page 53.	Table 43, column 1, line 4: '$H_4O_4O_{12}$' should read '$H_4P_4O_{12}$'.
Page 55.	Under cation K^+ the anion '$C(CoN)_6^{3-}$' should read '$Co(CN)_6^{3-}$'.
Page 70.	Second column, line 23. '$HN_3 + 11H^{2+} 8e^- = 3NH_4^+$' should read '$HN_3 + 11H^+ + 8e^- = 3NH_4^+$'.
Page 75.	Below Table 66: Cell B should read 'Ag, AgI'.
Page 79.	Table 72. In the NaI column at 2·5M, the value '8·925' should read '1·925'.
	In the $(NH_4)_2SO_4$ column at 0·1M, the value '0·852' should read '0·825'.
Page 83.	For 'ACETONITRIDE' read 'ACETONITRILE'.
Page 92.	Column 1, line 12: 'Cd^{III}' should read 'Cd^{II}'.

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